Reassessment of LLNL Waste Generation for Calendar Year 1995

John Celeste
Pollution Prevention Group Leader
Environmental Protection Department
Lawrence Livermore National Laboratory

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Executive Summary

This reassessment was prepared by the Pollution Prevention Group in the Environmental Protection Department to meet the requirements of the University of California Contract 48, Appendix F, waste minimization and source reduction performance measures. The Pollution Prevention Group has evaluated waste streams at Lawrence Livermore National Laboratory in terms of the total quantities of waste generated. However, the waste streams of greatest concern are not necessarily those identified as the largest by volume. Each process that generates waste and the individual characteristics of the components within each waste stream must be considered.

To better rank the waste streams and to improve the prioritization of waste minimization efforts, the Pollution Prevention Group has developed a new, alternative weighted ranking system. The methodology, previously approved in principle by the Department of Energy, assigns to each waste stream three weighting factors in addition to a factor based on quantity of waste generated annually. The three additional weighting factors use the following criteria: cost (including considerations such as permitting, handling, storing, training, and other costs), waste type (which includes compliance and potential liability considerations), and operational aspects (routine versus nonroutine wastes).

A weighting factor approach yields several clear advantages and insights compared to the previous analysis based exclusively on the quantity of each waste stream, and it can lead to a more cost-effective use of scarce resources. The LLNL source code is used to identify a process or activity responsible for generating the waste. This information is required to be entered on the waste requisition. The Pollution Prevention Group has worked with Hazardous Waste Management to improve the source code descriptions such that the waste will be consistently reported and the process or activity will be directly related to the waste generated. Under the new methodology, individual components of each source code are assessed and analyzed. When this is done, TRU / TRU mixed and low-level mixed wastes, which are problematic wastes at LLNL, are ranked as having the highest priorities. In general, the top 20 waste stream components ranked as having the highest priority by summing the four weighting factors provide an entirely different and markedly improved focus compared to the top 20 source codes ranked by quantity. Further refinements in the details of our methodology and in the specific assumptions underlying the assignment of individual weighting factors may be necessary.

1. Introduction: Background, Objectives, and Definitions

1.1 Background

The contract between the University of California (UC) and Lawrence Livermore National Laboratory (LLNL), when renewed in 1992, introduced performance measures as a mechanism by which to assess progress in meeting goals related to the environment, safety, and health. The performance measures relevant to this report concern waste minimization, waste reduction, recycling, and pollution prevention. Beyond efforts to minimize the impact of Laboratory operations on the environment, LLNL's success in meeting the performance measures may impact executive pay raises.

In 1993, the Department of Energy (DOE) and LLNL jointly selected three of five of the Laboratory's largest waste streams for waste reduction. The goal of reducing these process waste streams by an average of 5% per year has been met. In addition, a target reduction goal of 10% of the aggregate LLNL waste was established.

The performance measures have been modified each year since their inception. Nevertheless, the mandate to assess and prioritize LLNL waste streams is a continuing requirement.

In addition to LLNL's contractual requirements, DOE Secretary Hazel O'Leary established in 1996 the DOE goals for waste reduction. The following goals for routine operations are to be achieved by December 31, 1999 using calendar year (CY) 1993 as the baseline year:

- Reduce by 50% the generation of radioactive waste.
- Reduce by 50% the generation of low-level mixed waste.
- Reduce by 50% the generation of hazardous waste.
- Reduce by 33% the generation of sanitary waste.
- Reduce by 50% the total releases and off-site transfers for treatment and disposal of toxic chemicals.

1.2 Purpose of This Report

The purpose of this report is to discuss the weighting-factor approach that is being used at LLNL (1) to meet the UC contractual requirements for waste assessment and (2) to provide a systematic methodology for prioritizing the utilization of scarce resources (i.e., funding and manpower) for pollution prevention.

This analysis first highlights deficiencies in the current methods for identifying LLNL wastes. Recommendations for improved methods are then presented together with an analysis of the newly ranked top 20 LLNL waste streams for CY 1995.

1.3 Source Code: The Starting Point

The Pollution Prevention Group (PPG) in the Environmental Protection Department (EPD) has chosen to review LLNL waste generation data by using the source code of the waste stream. The source code is entered into the Hazardous Waste Management (HWM) Division's database for each waste requisition. The source code identifies the activity or process that has generated the waste. Thus, the source code is the starting point for the waste streams analysis. Each process must be well understood before source reduction opportunities can be meaningfully considered.

LLNL source codes are 3-digit numbers. The first two digits are assigned by the U. S. Environmental Protection Agency (EPA). For example, the EPA defines A94 as laboratory wastes. LLNL has defined A940 as laboratory wastes (excluding biomedical), and A942 as nonroutine laboratory wastes (i.e., close-out wastes). Appendix A provides a complete list of LLNL source codes.

Starting in 1995, LLNL began using the numeral "2" as the third digit to designate nonroutine wastes and to differentiate between these wastes and routine wastes, which are the relevant wastes for performance measures. The numeral "2" was chosen because the "origin code" in the HWM database should be a "2" for nonroutine waste.

During its review, the PPG found that nonroutine waste is frequently listed as routine waste. This problem is discussed in more detail in the context of individual source codes, and in Section 3 of this report, which describes the alternative weighting and ranking approach.

1.4 Definition of Terms

The following definitions and abbreviations are used to describe the waste types in the summary tables throughout this report:

Routine waste Normal operations waste produced from any type of production, analytical, and/or research and development laboratory operations; from treatment, storage, or disposal operations; from work for others; or from any periodic and recurring work that is considered ongoing.

Nonroutine waste	All other waste that is not routine waste and is not produced from normal operations; that is, all waste from any nonrecurring processes. However, wastes generated as a function of remediation efforts, even when such activity is ongoing, is considered to be nonroutine waste. Nonroutine wastes also include unused chemicals, legacy, lab close-out, and construction / demolition wastes.
DTSC waste	Department of Toxic Substances Control regulated waste. California-only hazardous waste. This waste is not recognized by the EPA (i.e., RCRA) as hazardous.
RCRA waste	Resource Conservation and Recovery Act regulated waste. Federal hazardous waste (also California hazardous). All RCRA waste is DTSC waste; however, the converse is not true.
TSCA waste	Toxics Substance Control Act regulated waste. Individual chemical wastes (both liquid and solid), such as polychlorinated biphenyls (PCBs) and asbestos, that are regulated by the TSCA.
Nonhazardous waste	Waste that is shipped from HWM as "industrial waste" and therefore does not go to a sanitary landfill.
Sewered waste	Waste that was considered to be potentially hazardous at one time and was eventually sewered. It may also include waste that was sewered after treatment.
Mixed waste	Waste containing both low-level radioactive and Federal hazardous components as defined by the RCRA.
LLW/CA waste	Waste containing low-level radioactive waste and California-only (i.e., DTSC) hazardous waste components.
Rad (radioactive) waste	Waste containing only low-level radioactive constituents.
Mixed-TSCA waste	Waste containing both TSCA and low-level radioactive components.
TRU waste	Transuranic waste.

2. Review of the Top 20 Source Codes by Quantity

Table 1 summarizes the top 20 LLNL waste streams in decreasing order for CY 1995, using the total quantity of waste (weight expressed in pounds) associated with each source code as the key measure. For each of the source codes, Table 1 also shows the total quantities of routine and nonroutine waste generation, according to the status provided by the HWM database. Figure 1 summarizes the same information in graphical form.

Following Table 1, each of the top 20 source codes is further broken down into waste types, and the individual waste types are discussed in more detail. Appendix B provides the complete list of all LLNL source codes and the total quantities of waste associated with each one, ranked in decreasing order.

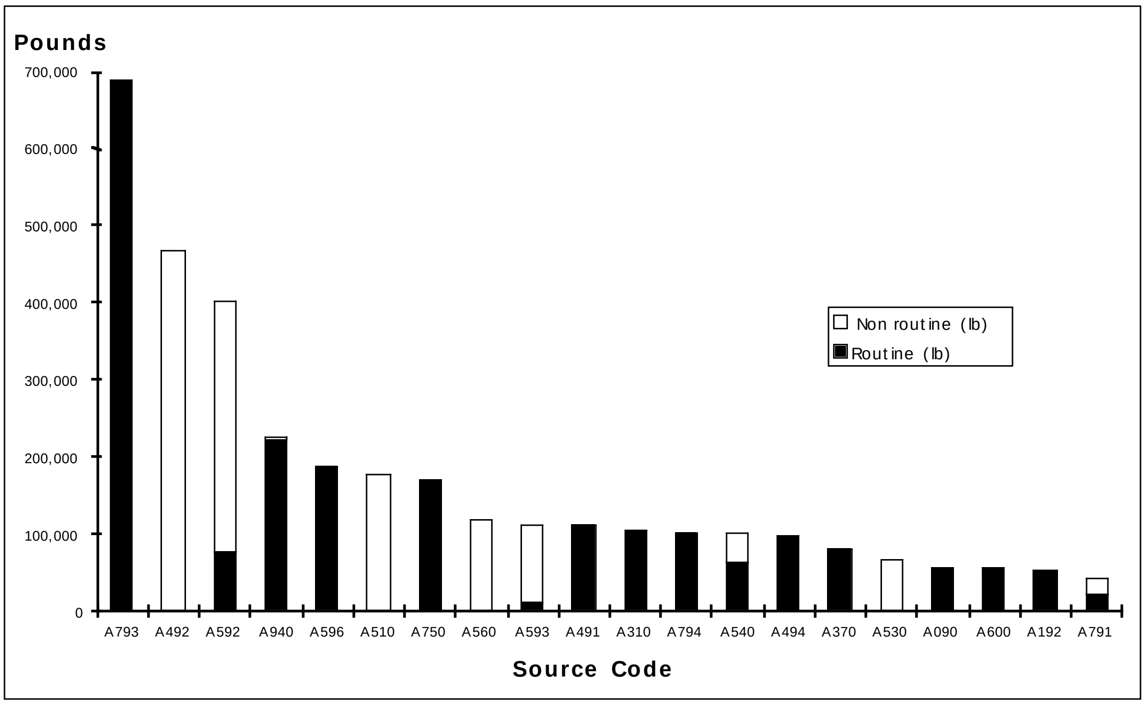

Figure 1. Calendar year 1995 waste streams by source code.

Table 1. Top 20 source codes ranked by quantity of waste for calendar year 1995.[a]

Rank	Source Code	Description	Routine (lb)	Non routine (lb)	Total (lb)	% of Total	Cum. % of total
1	A793	Waste analysis (i.e., samples) and berm water collection	687,583	—	687,583	18	18
2	A492	Building construction and renovation	—	467,114	467,114	12	30
3	A592	Demolition/decontamination	76,313	326,458	402,771	11	41
4	A940	Laboratory wastes (excluding biomedical) (i.e., spent solutions, lab trash, etc.)	223,648	1,148	224,796	6	46
5	A596	Emptying retention tanks	185,855	—	185,855	5	51
6	A510	Building maintenance	—	176,928	176,928	5	56
7	A750	Wastewater treatment	168,486	977	169,463	4	60
8	A560	Discontinue use of process equipment	—	119,693	119,693	3	63
9	A593	Equipment maintenance operations	11,553	98,466	110,020	3	66
10	A491	Machining/welding operations	109,502	—	109,502	3	69
11	A310	Product rinsing	103,460	—	103,460	3	72
12	A794	Berm water collection	99,994	—	99,994	3	75
13	A540	Oil changes-maintenance	63,377	35,790	99,167	3	77
14	A494	Cooling processes (machine/computer, etc.)	98,499	—	98,499	3	80
15	A370	Spent process liquids removal	79,224	—	79,224	2	82
16	A530	Nonroutine leak collection	—	65,948	65,948	2	83
17	A090	Clean out process equipment	55,257	374	55,631	1	85
18	A600	Sludge removal	54,689	—	54,689	1	86
19	A192	Steam cleaning operation	51,792	—	51,792	1	88
20	A791	Asbestos removal/abatement	20,600	19,600	40,200	1	89

[a] In mid-1995, some of the source codes were changed: A793 and A794 were both used for berm water. During this transition, some nonroutine waste was not designated with a “2” for the last digit.

2.1 Analysis of the Top 20 Waste Streams by Quantity

This section provides a more detailed analysis of each of the major processes that generated waste at LLNL in CY 1995. The purpose of such a detailed assessment in this report is to point out the inherent weaknesses of using quantity as the single criterion for prioritizing LLNL wastes streams.

Each source code is first broken down into the categories of waste generated (i.e., DTSC, RCRA, mixed, and so forth). Each category of waste is then further identified as routine or nonroutine, and the total quantity (by weight) is specified. This information is summarized in a table for each source code. Following each table, a description of the waste streams and the processes is provided.

One of the principal purposes of a source code is to identify a category of similar processes. However, our analysis shows that this may not always be the case, and it reveals several related issues that need to be addressed.

First, the PPG worked with HWM personnel to redefine some of the source codes in CY 1995. Because this effort took place about mid-year, the 1995 data contain some old source codes along with new source codes. Discrepancies in source codes that are artifacts of this transition period are identified where they occur.

Second, one source code may have been used to describe wastes that represent routine activities only, nonroutine activities only, or both routine and nonroutine activities.

In CY 1996 and thereafter, it will be easier to sort through the database and to distinguish routine from nonroutine waste because all nonroutine waste must now end in the number “2.” This is an important consideration in reporting on performance measures and in generating annual reports. After the transition period of redefining the source codes, it will be possible to readily distinguish among these waste types or to identify an inaccurate entry in the database.

Third, and perhaps most important in terms of prioritizing waste streams, one source code can encompass a variety of individual wastes with very different characteristics. Thus, a relatively small quantity of a “problematic” waste may not be readily apparent. This fact further complicates attempts to prioritize waste streams and to identify problematic wastes when any single factor, such as total quantity alone of a given source code, is used for the assessment. This inherent problem is not addressed by merely redefining some source codes. However, the problem is addressed and solved by the new weighting-factor methodology discussed later.

2.1.1 Source Code A793

Table 2 A793—berm water and waste analysis (i.e., samples)

Source code	Waste category	Routine/nonroutine	Total (lb)
A793	DTSC	Routine	4
A793	LLW/CA	Routine	42
A793	Mixed	Routine	1,301
A793	Nonhazardous	Routine	2,739
A793	RCRA	Routine	370
A793	Sewered	Routine	683,127
Total			687,583

Analysis of the waste stream

All A793 wastes are routinely generated. Approximately 99% of A793 wastes consist of rainwater that is collected in bermed areas and other retention structures. The majority of this waste is ultimately sewered. Thus, most of this waste stream offers little opportunity for cost-effective source reduction. In fact, the EPD is directly connecting several bermed areas to the sewer where technically feasible. The bermed water will be tested in place and sewered if nonhazardous instead of the current method of pumping out bermed areas and taking the water to HWM for sewering.

The largest sources of collected rainwater are the bermed areas in the immediate vicinity of B612 and B514, which together contribute 84% of this routinely generated waste. Bermed waste water is also coded as A794. This is a transition artifact that is due to the redefined source codes.

Less than 1% of A793 wastes are mixed wastes from various sampling and analytical processes. Two scenarios generate this A793 mixed waste. First, during sampling and analysis, we routinely pump groundwater for testing and treatment. During the analytical process, background levels of radioactive material (including naturally occurring tritium) in the groundwater are concentrated until they are above the levels that allow the water to be discharged back to the ground. Second, the spent ion-exchange columns used for groundwater analysis are backflushed with salt water, which contains ^{40}P. The A793 mixed wastes from such sampling and analytical protocols are containerized and shipped off site.

Clearly, combining several very different waste types, such as sewered and mixed wastes into one source code can be a problem in terms of efforts to prioritize waste streams for minimization and pollution prevention. However, our new methodology addresses the issue by differentially segregating and ranking the different waste types (e.g., mixed versus nonhazardous) that can appear under one source code. Thus, the smaller quantities of “problematic” wastes are ranked higher than the larger volumes of less hazardous waste.

2.1.2 Source Code A492

Table 3. A492—building construction/renovation

Source code	Waste category	Routine/ nonroutine	Total (lb)
A492	DTSC	Nonroutine	8,493
A492	LLW/CA	Nonroutine	415
A492	Nonhazardous	Nonroutine	230
A492	Rad	Nonroutine	387
A492	RCRA	Nonroutine	456,674
A492	Sewered	Nonroutine	415
A492	TSCA	Nonroutine	500
Total			467,114

Analysis of the waste stream

All A492 wastes represent nonroutine activities and were accurately reported in the database. Of these wastes, 97% are contaminated (RCRA) soils removed from the vicinity of B404 and from the cooling tower demolition near B431. Thus, even though A492 wastes appear on the top-20 list by weight, as nonroutine wastes they are not of ongoing concern for minimization and pollution prevention. Reuse, segregation, and recycling are the waste minimization options that are now considered to be the best management practice for construction and renovation projects.

2.1.3 Source Code A592

Table 4. A592—demolition/decontamination

Source code	Waste category	Routine/ nonroutine	Total (lb)
A592	DTSC	Routine	44,150
A592	DTSC	Nonroutine	3,025
A592	LLW/CA	Routine	10
A592	Mixed	Routine	25,076
A592	Nonhazardous	Routine	922
A592	Nonhazardous	Nonroutine	18
A592	Rad	Routine	2,530
A592	Rad	Nonroutine	12,025
A592	RCRA	Routine	3,625
A592	RCRA	Nonroutine	310,257
A592	TSCA	Nonroutine	1,132
Total			402,771

Analysis of the waste stream

By definition, all A592 wastes are nonroutine. In the HWM database, 81% were reported to be generated as a result of nonroutine operations. Of the nonroutine component of this waste, 95% is contaminated (RCRA) wood debris from the cooling tower outside B435. Radioactive waste represented about 3% of the nonroutine component, with gravel washing at B804 the single largest source. Gravel washing is a remediation activity and is, by definition, nonroutine.

However, in the database, approximately 13% of A592 wastes was called routine incorrectly. Fluorescent light bulbs and light ballasts are the largest of these individual waste streams at 5% and 2.6% of the total A592 waste quantity, respectively. The light conversion (i.e., re-lamping) activities are a site-wide conversion from old style ballasts to the newer electronic ballasts. The old bulbs are not compatible with the new ballasts. The used light bulbs are currently being taken to Donation, Utilization, and Sales for resale or give away as opposed to shipping them off site for mercury recycling. This one-time-only waste should have been identified as nonroutine.

Mixed waste represents 6.2% of the total, with laboratory sink wastewater in tank R1U2 from B151 as the single largest source at 5.6%. B151 is the nuclear chemistry building where scintillation cocktails are used in analytical labs to identify radioisotopes. Further review showed that this waste was not mixed, but was, in fact, low-level waste that exceeded the sewer-discharge requirements. Typically, the retention tank water from B151 is sewerable. Thus, this waste represents an off-normal event, but from routine operations. The retention tank waste from B151 should not have been identified as A592 waste.

2.1.4 Source Code A940

Table 5. A940—laboratory wastes (excluding biomedical) (i.e., spent solutions, lab trash, etc.)

Source code	Waste category	Routine/ nonroutine	Total (lb)
A940	DTSC	Routine	36,562
A940	LLW/CA	Routine	9,755
A940	Mixed	Routine	47,886
A940	Mixed	Nonroutine	50
A940	Mixed - TSCA	Nonroutine	72
A940	Nonhazardous	Routine	24,640
A940	Rad	Routine	26,901
A940	Rad	Nonroutine	774
A940	RCRA	Routine	32,461
A940	RCRA	Nonroutine	1
A940	Sewered	Routine	45,443
A940	TSCA	Nonroutine	252
Total			224,796

Analysis of the waste stream

Approximately 99% of A940 wastes are routinely generated. The hazardous (RCRA and DTSC) component is the largest, comprising 30% of the total A940 waste. Other major components of the A940 waste stream include mixed waste (21%), sewerable waste (20%), and radioactive waste (13%).

DTSC hazardous wastes represent 16% of the total A940 stream, and RCRA hazardous wastes 14%. Major DTSC waste streams include spent aqueous ethanol solution from B492 (68% of DTSC wastes), and cooling water from condensers and accumulators collected outside of B241 (11% of DTSC wastes). RCRA wastes are routinely generated in many small quantities throughout the site, with the notable exceptions of laser dye solution from B492 (14% of RCRA), and a copper sulfate solution used in metal-plating operations in B322 (26% of RCRA).

The ethanol recycling project was funded in the high-return-on-investment project for B492. Because the future generation of ethanol is expected to significantly exceed CY 1995 generation, ethanol was proposed as one part of a new waste minimization effort for this performance measure.

The single largest sewerable A940 waste stream is rinse water from B231, comprising 47% of the sewerable component. Other significant sewerable streams include waste water from lab sinks in B531 (27% of sewerable total), and process waste water from room 100, B187 (16% of sewerable total).

Wastewater from laboratory sinks in B151 that collects in the R1U2 retention tank is the single largest mixed waste stream, contributing 55% of the mixed A940 component. This same waste was listed as an A592 waste as well. Other significant mixed A940 streams include contaminated water from room 100, B187 (23% of the mixed A940 total), and "purolite" resin beads from a hexavalent chromium recovery unit in B187 (7% of the mixed A940 total). This waste is from ground water remediation and is nonroutine waste by definition. It should have been identified as A612 (superfund remediation).

Source code A940 is often used as a catchall, as is obvious from the above examples. As a result, individuals analyzing LLNL waste by source code are often misled into believing that source-reduction opportunities exist when they are not, in fact, good investments of time or money. More descriptive source codes should be used instead, where possible.

2.1.5 Source Code A596

Table 6. A596—emptying retention tanks

Source code	Waste category	Routine/nonroutine	Total (lb)
A596	DTSC	Routine	5,055
A596	Mixed	Routine	208
A596	Nonhazardous	Routine	36,079
A596	Rad	Routine	60
A596	RCRA	Routine	4,980
A596	Sewered	Routine	139,474
Total			185,855

Analysis of the waste stream

All A596 wastes are categorized as routine, and the majority of them are ultimately sewered. Thus, most of these waste streams probably offer little opportunity for cost-effective source reduction.

Aqueous waste water from B531 is the single largest sewerable waste stream, at 18% of the total. Microchip processing in B153 produces 17% of A596 wastes, including sewerable, RCRA hazardous, and nonhazardous waste streams. Sewerable waste water from laboratory sinks in B151 and B177 comprise 13% and 12.8%, respectively, of the A596 wastes. Rinse water wastes from R1A1 at

B231, representing 9.8 % of the total, are either sewerable or nonhazardous. Cooling water from B175, a nonhazardous waste, represents 9% of the total. Sewerable process waste water from retention tanks outside B332 comprises an additional 8% of the total.

It is likely that the small quantities of rad and mixed A596 wastes are not from retention tanks because such tanks are high-volume systems. Due to the sampling and analytical costs associated with the rad and mixed wastes, some cost-effective options may be worth exploring. Once again, however, the rad and mixed quantities of A596 wastes are essentially hidden in the total.

2.1.6 Source Code A510

Table 7. A510—building maintenance

Source code	Waste category	Routine/nonroutine	Total (lb)
A510	DTSC	Nonroutine	27,064
A510	Nonhazardous	Nonroutine	664
A510	Rad	Nonroutine	457
A510	RCRA	Nonroutine	381
A510	Sewered	Nonroutine	148,363
Total			176,928

Analysis of the waste stream

Sewerable rainwater collected from the B865 transformer berm, the retention system outside of B153, and the B819 steam pad sump are the three single largest waste streams, comprising 40% , 23%, and, 19% of A510 wastes, respectively. These waste streams should have been identified as berm water and recorded under another source code.

Approximately 15% of the A510 waste type is considered hazardous (DTSC). B801 is the single largest source of hazardous (DTSC) A510 waste. Waste oil/water mixtures and other inorganic aqueous solutions collected from outside B801 comprise 10% of the A510 total, and 68% of the hazardous (DTSC) component. Compressed air condensate from B815 is the second largest hazardous waste stream, comprising 4% of the A510 total, and 26% of the hazardous component. Radioactive, nonhazardous, and RCRA hazardous wastes total less than 1% of the A510 waste type. These wastes were reviewed during the preparation of the California hazardous waste source reduction report. All of the water/oil mixtures from B810, B865, and B819 are sent off site for recycling, which appears to be a cost-effective solution at present. For the air-compressor condensate, the best source reduction opportunity is to use oil-free compressors.

The radioactive waste is once again lost in comparison with the larger quantities of other wastes identified under source code A510.

2.1.7 Source Code A750

Table 8. A750—wastewater treatment

Source code	Waste category	Routine/nonroutine	Total (lb)
A750	DTSC	Routine	465
A750	LLW/CA	Routine	10,338
A750	Mixed	Routine	18,931
A750	Mixed	Nonroutine	90
A750	Nonhazardous	Routine	74,185
A750	RCRA	Routine	3,977
A750	Sewered	Routine	60,590
Total			169,463

Analysis of the waste stream

Of A750 wastes, 99% are routinely generated, with nonhazardous and sewerable wastes comprising 80% of the total. 39% of routine A750 wastes are nonhazardous rinse waters after treatment by transportable treatment units used at B141. Wastewater from the B332 R1U2 retention system and from the storage yard at B141 represents 4% and 1%, respectively, of the nonhazardous total. Rinse water from the transportable treatment units used at B141 is the single largest sewerable A750 waste stream, comprising 34% of the total. Rainwater from the B 819 steam cleaning sump is sometimes sewerable and represents 2% of the A750 total. This component should have been placed in the berm water source code. Mixed waste is routinely generated from treatment operations (i.e., using the Dorr Oliver™ treatment system in B514), as is LLW/CA waste, with respective contributions of 11% and 6%.

HWM has purchased a new cold evaporation system that will be able to treat most, if not all, of the waste that the Dorr Oliver system treats. Due to funding constraints and RCRA Part B permit modifications, this new unit will not be operational until after January 1997 at the earliest. The system may be able to significantly reduce the filter cake waste generated at B514.

2.1.8 Source Code A560

Table 9. A560—discontinued use of process equipment

Source code	Waste category	Routine/nonroutine	Total (lb)
A560	DTSC	Nonroutine	40,725
A560	LLW/CA	Nonroutine	4
A560	Mixed	Nonroutine	10,523
A560	Nonhazardous	Nonroutine	211
A560	Rad	Nonroutine	390
A560	RCRA	Nonroutine	13,676
A560	TSCA	Nonroutine	54,164
Total			119,693

Analysis of the waste stream

Source code A560 has been changed to A562 since, by definition, all A560 wastes are categorized as nonroutine. Thus, even though A560 wastes appear in the top-20 list by weight, there are few source reduction alternatives. However, each piece of discontinued equipment is evaluated for recycling opportunities

The largest components of this waste stream are TSCA wastes (45%), DTSC wastes (34%), RCRA wastes (11%), and mixed wastes (9%). Twelve transformers from the storage yard at B690, and waste transformer oil from the yard at B431 together comprise 96% of the TSCA component of A560 wastes. Of the DTSC waste component, 85% is waste transformer oil from B431, B432, and the B431 yard.

About 91% of the RCRA component is degraded (acidified) zinc bromide solution from the hot cells in B412. This solution was generated as a result of the facility closure. 95% of the mixed waste component is decontamination rinse water from the B819 steam pad closure. These wastes should have been identified as A592 wastes (demolition and decontamination).

2.1.9 Source Code A593

Table 10. A593—equipment maintenance operations

Source code	Waste category	Routine/nonroutine	Total (lb)
A593	DTSC	Routine	6,314
A593	DTSC	Nonroutine	46,471
A593	Mixed	Nonroutine	655
A593	Mixed - TSCA	Nonroutine	386
A593	Nonhazardous	Routine	2,274
A593	Nonhazardous	Nonroutine	415
A593	Rad	Routine	60
A593	Rad	Nonroutine	185
A593	RCRA	Routine	623
A593	RCRA	Nonroutine	2,650
A593	Sewered	Routine	2,283
A593	Sewered	Nonroutine	5,405
A593	TSCA	Nonroutine	42,300
Total			110,020

Analysis of the waste stream

Approximately 89% of A593 waste is categorized as nonroutine, with hazardous (DTSC) and TSCA wastes contributing 42% and 38% of the total, respectively. Routinely generated hazardous (DTSC), nonhazardous, and sewerable wastes, respectively, account for 6%, 2%, and 2% of A593 wastes.

A single 42,100-pound transformer from B431, and capacitors from B432 comprise 99% of the nonroutine DTSC waste, while another transformer from B432 represents 100% of the nonroutine TSCA component of A593. These wastes should have been identified as A562 wastes instead of originating from equipment maintenance.

Fluorescent light tubes and ballasts are the largest routine DTSC wastes. Rainwater from B432 and steam pit sludge from B511 are the largest routine nonhazardous wastes. These two components should have been placed in the berm water source code. Rinse water from the ammonia tank and pipes (M1U2) at B131 is the largest routinely sewerable component of A593 waste.

2.1.10 Source Code A491

Table 11. A491—machining/welding operations

Source code	Waste category	Routine/nonroutine	Total (lb)
A491	DTSC	Routine	53,426
A491	LLW/CA	Routine	3,698
A491	Mixed	Routine	910
A491	Nonhazardous	Routine	36,845
A491	Rad	Routine	2,334
A491	RCRA	Routine	12,288
Total			109,502

Analysis of the waste stream

All A491 waste is routinely generated. The majority of A491 waste is Engineering's TrimSol waste at 51,513 lb (47%) or TrimSol-related waste (pigs, rags, filters, etc.). This waste consisted mostly of hazardous RCRA waste, with some DTSC and a small amount of nonhazardous waste. Approximately 830 lb of coolant was mixed waste. Another large contributor to the A491 waste stream was from the water jet cutting operation (33%) at 36,541 lb. This waste consisted of sludge removed by the water recycling unit and sump cleanout. It was mostly nonhazardous but contained some metals that caused this stream to be identified as "Industrial Waste." Some LLW waste was created from machining D-38 (2.5%) 2,686 lb. Some rad waste, 2,334 lb (2%), was from used stainless steel drums. Another small nonhazardous stream was graphite machining waste at 1,600 lb (from the Laser Directorate).

2.1.11 Source Code A310

Table 12. A310—product rinsing

Source code	Waste category	Routine/nonroutine	Total (lb)
A310	DTSC	Routine	102,588
A310	RCRA	Routine	872
Total			103,460

Analysis of the waste stream

Approximately 99% of A310 waste is routinely generated at B865. The waste stream consisted of water slightly contaminated with insulating oil. This waste was sent off-site for recycling and was previously discussed in the report prepared for the California hazardous waste reduction act (SB14).

2.1.12 Source Code A794

Table 13. A794—berm water collection

Source code	Waste category	Routine/nonroutine	Total (lb)
A794	Sewered	Routine	99,994
Total			99,994

Analysis of the waste stream

All A794 wastes consist of rainwater, which is collected in bermed areas and other retention structures, the majority of which is ultimately sewered. Thus, this waste stream offers little or no opportunity for cost-effective source reduction.

As explained previously, source code A793 also includes berm water. The use of more than one source code for the same kinds of waste streams is a transition artifact in moving from old to new source code numbers. However, in several instances, berm water was not properly identified with a correct source code. To correct this problem, the PPG is developing training sessions and handouts for waste generators and HWM field technicians who fill out the requisitions.

2.1.13 Source Code A540

Table 14. A540—oil changes and maintenance

Source code	Waste category	Routine/nonroutine	Total (lb)
A540	DTSC	Routine	35,473
A540	LLW/CA	Routine	771
A540	Mixed	Routine	1,331
A540	RCRA	Routine	25,803
A540	TSCA	Nonroutine	35,790
Total			99,167

Analysis of the waste stream

Fleet oil changes, including oil from the motor pool and heavy equipment, represents 33,335 lb or 53% of the routinely generated A540 waste stream. This value is significantly reduced from the amount generated in previous years through the use of an oil analyzer. The analyzer allows oil to be changed when required rather than in conformance to a standard time schedule.

Plant Engineering oil wastes include transformer oil (7951 lb or 12.5%), vacuum pump oil (5046 lb or 8%), and air conditioning oil (3735 lb or 6%).

Of the routinely generated A540 wastes, approximately 1,900 lb (3%) of DTE-25 hydraulic fluid is from a metal spin-forming unit in B231 (Chemistry and Materials Science). The Engineering directorate contributes about 800 lb of vacuum pump oil and 4650 lb (7%) as dielectric oil or hydraulic oil in equipment in B231 and B321. Lasers contributes another 1,233 lb (2%) mostly from vacuum pump oil. Various directorates generated 758 lb of LLW waste from containers / oil and 1329 lb of mixed oil. In FY 96, the EPD purchased a reconditioning unit for the vacuum pump oil, which Engineering will operate. This synthetic vacuum pump oil costs $800 per gallon.

Of the nonroutine A540 waste stream, 100% (35,790 lb) was claimed by the Plant Directorate as nonroutine transformer oil changes.

2.1.14 Source Code A494

Table 15. A494—cooling processes (machine/computer, etc.)

Source code	Waste category	Routine/nonroutine	Total (lb)
A494	DTSC	Routine	5,690
A494	LLW/CA	Routine	3,973
A494	Mixed	Routine	4,980
A494	Nonhazardous	Routine	42,289
A494	RCRA	Routine	67
A494	Sewered	Routine	41,501
Total			98,499

Analysis of the waste stream

All 494 wastes are routinely generated. About, 66,400 lb (67%) of A494 waste was from the B490 closed-loop cooling system. The system was drained, and a corrosion inhibitor was added. Of the total waste generated from the cooling system, 41,500 lb was sewered, and the rest was nonhazardous but nonsewerable. Another large stream , 4565 lb (5%), was from a chiller in B492. The remainder of the A494 waste stream was TrimSol waste, mixed waste, and LLW waste (11,235 lb, or 11%). Here again, TrimSol is characterized as a cooling process, but was previously used in machining operations.

2.1.15 Source Code A370

Table 16. A370—spent process liquids removal

Source code	Waste category	Routine/nonroutine	Total (lb)
A370	DTSC	Routine	43,326
A370	LLW/CA	Routine	0
A370	Mixed	Routine	14,152
A370	Nonhazardous	Routine	1,370
A370	Rad	Routine	4,524
A370	RCRA	Routine	9,558
A370	Sewered	Routine	6,296
Total			79,224

Analysis of the waste stream

All 370 wastes were listed as routinely generated. However, about, 41,500 lb (52%) was Diala Oil (dielectric oil) from B865 (Lasers). Because this oil was drained from a transformer that was excessed, it should have been listed as nonroutine. Another (23%) was ground water remediation waste (ion-exchange) from B187. This waste should also have been listed as nonroutine because remediation is defined as nonroutine. Most of this waste was mixed with the exception of 4980 lb, which was sewered. In effect, 75% of the A370 waste was actually nonroutinely generated. Thus, at least this portion of the A370 waste stream is of limited concern for minimization and pollution prevention.

The routine A370 rad waste is from the tank farm treatment unit in B514 (4,524 lb, or 6% of the total). B141 operations contributed 4,440 lb (6%) of hazardous waste. B492 contributed 3,030 lb (4%) of laser dye waste. The DOE has funded a return-on-investment project to install an ethanol recycling unit at the AVLIS facility to reduce the laser dye waste.

2.1.16 Source Code A530

Table 17. A530—nonroutine leak collection

Source code	Waste category	Routine/nonroutine	Total (lb)
A530	DTSC	Nonroutine	44,543
A530	Mixed - TSCA	Nonroutine	148
A530	Nonhazardous	Nonroutine	1,238
A530	Rad	Nonroutine	135
A530	RCRA	Nonroutine	1,262
A530	Sewered	Nonroutine	18,210
A530	TSCA	Nonroutine	413
Total			65,948

Analysis of the waste stream

All A530 waste is considered to be nonroutine by definition and should end in "2." Approximately 47% of the A530 waste stream was generated at B850 and consisted of inorganic solid asphalt and dirt. This component probably should have been identified as A592 waste. About 23% was collected at an emergency eye wash in the Waste Accumulation Area at B332. 4% was rainwater and water from a broken pipe at the B883 storage area. Another 3% was waste from a gasoline spill cleanup at B612. Because these wastes represent nonroutine activities, they are of limited concern for minimization and pollution prevention.

2.1.17 Source Code A090

Table 18. A090—clean out process equipment

Source code	Waste category	Routine/nonroutine	Total (lb)
A090	DTSC	Routine	2,301
A090	Nonhazardous	Routine	573
A090	Rad	Routine	16,185
A090	RCRA	Routine	30,699
A090	RCRA	Nonroutine	374
A090	Sewered	Routine	5,499
Total			55,631

Analysis of the waste stream

Almost all of the A090 wastes are routinely generated. Hazardous sludge from the plating shop water-treatment system accounted for 10,831 lb (20%). Rad process rinse water from B231 tank R1A1 represented 6,225 lb. (11%).

Radioactive rinse water was generated at Site 300 as the result of the remediation of spent gravel from the firing tables. The firing table gravel is used to absorb shock waves generated by explosive testing. This rinse water accounted for 9,960 pounds of the radioactive waste and 18% of the total for this source code. Also, the 5,478 pounds of sewered waste was generated by the reconditioning unit during the initial testing. Since the waste was generated from a remediation process it should be considered non-routine.

Hazardous Gun Debris (soot, rags, etc.) from B341 comprised 1,830 lb (3%). Plant Directorate claimed 374 lb as nonroutine hazardous sludge from the car wash sump. If so, this waste should have been listed under source code A600.

2.1.18 Source Code A600

Table 19. A600—sludge removal

Source code	Waste category	Routine/nonroutine	Total (lb)
A600	DTSC	Routine	1,966
A600	RCRA	Routine	51,063
A600	Sewered	Routine	1,660
Total			54,689

Analysis of the waste stream

All 600 wastes are routinely generated. Hazardous cooling tower sludge from B291 represented 33,200 lb (61%), and hazardous cooling tower sludge from B435 represented 8,300 (15%). Hazardous steam pit sludge from B511 contributed 1,486 lb (3%), and steam pit sludge from B819 contributed 7,678 lb (14%). A return-on-investment project to reduce the sludge from the cooling towers has been funded for FY 1997.

2.1.19 Source Code A192

Table 20. A192—steam cleaning operation

Source code	Waste category	Routine/nonroutine	Total (lb)
A192	DTSC	Routine	415
A192	RCRA	Routine	13,944
A192	Sewered	Routine	37,433
Total			51,792

Analysis of the waste stream

This source code has been changed to A193 because it identifies routine waste. Approximately 58% of this waste stream is routine waste generated at B879 from steam trap and sump clean out and maintenance. Of the waste from B879, about 25% was a RCRA waste, and about 33% was sewered.

Approximately 30% of the A192 waste was generated at B819 from steam cleaning operations and rain water that was collected in bermed areas. This waste was sewered.

Approximately 10% of the A192 waste was generated at B419 from steam cleaning of metal parts. This waste was entirely sewered.

2.1.20 Source Code A791

Table 21. A791—asbestos removal/abatement

Source code	Waste category	Routine/nonroutine	Total (lb)
A791	DTSC	Routine	11,800
A791	Nonhazardous	Routine	8,800
A791	TSCA	Nonroutine	19,600
Total			40,200

Analysis of the waste stream

All A791 waste is classified as nonroutine by definition. However, the database did not designate all of the waste properly. The source code has since been changed to A792 to reflect the nonroutine nature of this waste. About 83% of the waste was generated by the removal of asbestos tile, pipe, and pipe insulation from site-wide removal operations. The remainder, about 17%, was generated from wall board removal that contained asbestos. Because these wastes represent nonroutine activities, they are of limited concern for minimization and pollution prevention.

2.2 Shortcomings of Prioritizing Waste Streams by Quantity

The analysis and evaluation in the previous section required an enormous amount of manpower and did very little to identify new source reduction opportunities. The top 20 LLNL waste streams ranked by quantity for CY 1995 do not represent the most effective starting point for prioritizing source reduction efforts. All or most of the wastes in at least six of the top 20 source codes consist of sewerable water (A192, A510, A596, A750, A793, and A794). A large portion of the waste in source code A494 is also sewered. Five additional source codes on this list consist entirely of nonroutinely generated wastes (A492, A530, A560, A592, and A791). Two additional source codes on the list consist mostly of nonroutine wastes (A370, and A593). Thus, for at least 14 of the top 20 waste streams ranked by quantity, either all or the majority of components probably do not warrant further consideration from the standpoint of a cost-effective use of scarce resources.

Furthermore, other considerations limit the likelihood that several of the remaining source codes warrant attention. In some instances, apparent source-reduction opportunities are not a good investment of time or money (e.g., A940). In other cases, alternative processes are either being developed (e.g., A750) or have already been put in place (e.g., A540) to minimize the waste streams. Conversely, virtually hidden within several source codes lie certain hazardous components that should be considered in more detail. However, these instances are actually obscured in an assessment of waste streams focused exclusively on source codes by total quantity. Finally, the most problematic (but smaller-volume) wastes, such as TRU and mixed wastes, are overlooked in the assessment. Clearly, an alternative approach is needed.

3. Analysis of LLNL Waste Streams for CY 1995 Using a Weighting Factor Approach

The LLNL source reduction effort needs to be applied to the waste streams of highest concern. The waste streams of highest concern are not necessarily those that are generated in the largest quantities. Thus, the PPG has established an alternative methodology to prioritize LLNL waste streams by adding other factors into the equation besides the total quantity of waste generated annually.

Previously, John Celeste of the PPG submitted to the DOE for review a weighted ranking system for LLNL waste stream prioritization. The results were discussed with the DOE in January and February 1996. This system ranked TRU/TRU mixed and low-level mixed wastes as the LLNL waste streams of highest priority. The methodology has been adopted by the DOE/OAK and is now incorporated into the new LLNL contract performance measures.

Since the meetings, the PPG has reviewed the processes that generated each newly prioritized waste stream and has been evaluating pollution prevention opportunities. This section presents the results.

3.1 Methodology

The new methodology has been set up in a spreadsheet application to more easily change assumptions and parameters, and to immediately assess the impact of such changes on the overall prioritization of waste streams. The relevant data (a subset from the HWM database) are first loaded into a spreadsheet. The weighting factors—quantity, avoided cost, waste type, and the type of operation (routine versus nonroutine)—are then set up in simple look-up tables and linked to the master spreadsheet. The total points assigned to each waste stream is simply the sum of the applied weighting factors. Future work may integrate the system directly into the HWM database.

As discussed in Section 2 of this report, the PPG analyzed the LLNL waste streams by source codes and discovered that each source code is not one entity. Rather, a source code is similar to a family with several, potentially very different, elements or siblings. Thus, the prioritization of waste streams cannot be meaningfully collapsed simply on the basis of the source code alone. Instead, it must include the individual characteristics of each sibling within each source code.

Table 22 is a summary of the newly ranked top 20 siblings in descending order of importance (i.e., decreasing total points calculated by summing the four weighting factors). When the weighting total was the same value, the ranking is by quantity in descending order. Each waste stream description now includes the source code, waste type, and its routine or nonroutine characteristics. For each waste stream, the four factors are evaluated and assigned a value.

Table 22. Newly ranked LLNL waste streams using weighting factors.

Rank	Waste stream description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
1	Source code: none TRU/TRU mixed routine	21,600	5	10	10	5	30
2	Source code: A940 mixed routine	47,886	10	5	7	5	27
3	Source code: A592 mixed routine	25,076	5	5	7	5	22
4	Source code: A750 mixed routine	18,931	5	5	7	5	22
5	Source code: A370 mixed routine	14,152	5	5	7	5	22
6	Source code: none Ethanol recycling ROI project, RCRA routine	310,250	10	1	5	5	21
7	Source code: A600 RCRA routine	51,063	10	1	5	5	21
8	Source code: none CFC 113 recycling ROI project, RCRA routine	50,000	10	1	5	5	21
9	Source code: A310 DTSC routine	102,588	10	1	4	5	20
10	Source code: A491 DTSC routine	53,426	10	1	4	5	20
11	Source code: A592 DTSC routine	44,150	10	1	4	5	20
12	Source code: A370 DTSC routine	43,326	10	1	4	5	20
13	Source code: A940 DTSC routine	36,562	10	1	4	5	20
14	Source code: A540 DTSC routine	35,473	10	1	4	5	20
15	Source code: A560 mixed nonroutine	10,523	5	5	7	1	18
16	Source code: A610 mixed nonroutine	6,873	5	5	7	1	18
17	Source code: A494 mixed routine	4,980	1	5	7	5	18
18	Source code: A792 mixed routine	3,103	1	5	7	5	18
19	Source code: A540 mixed routine	1,331	1	5	7	5	18
20	Source code: A793 mixed routine	1,301	1	5	7	5	18

3.2 Discussion of Weighting Factors

The revised prioritization of waste streams in Table 22 is an obvious improvement over the previous assessment based exclusively on quantity (compare with rankings in Table 1). However, the rankings are a function of many assumptions; most importantly, what values (specific weightings) are assigned for each of the four factors. The following four tables show the values used in the present analysis.

For example, we assigned a value of 0.001 to represent the cost associated with sewered waste and a value of 1 to represent the cost of RCRA waste. These assigned values imply that it is, in general, 3 orders of magnitude more costly to compliantly treat, store, and dispose of RCRA waste than sewered waste. Similarly, we assigned a value of 10 to represent TRU waste, implying that the costs associated with TRU waste are roughly one order of magnitude greater than those associated with RCRA waste. This weighting factor for TRU waste may actually be too low compared to that for RCRA waste.

Many complex issues underlie each of the assigned values. Thus, our analysis is the starting point for subsequent discussions. In addition, because our current model can rapidly generate revised rankings when any single or combination of parameters is varied, it lends itself to a rapid sensitivity analysis. Not only can we account for differences in the siblings, but we can also quickly change the weighting factors to perform “what-if” scenarios.

A histogram, which is a useful tool in sensitivity analysis, is a way of binning results to readily see how many individuals reside in each bin. Figure 2 shows the results of applying the four weighting factors from Tables 23 through 26 to all of the siblings in the HWM database for CY 1995. The tabulation from which these values are derived is over five pages long; thus, the histogram permits visualizing the large data population.

A common distribution on a histogram is a bell-shaped curve. A significant departure from such a normal distribution would suggest that the assigned weights do not allow for a clear differentiation among the waste streams. This would be the case, for example, if one weighting factor were too dominant. The assigned weighting factors, and the results in Figure 2, yield an approximately normal distribution and a clear differentiation of the waste stream siblings.

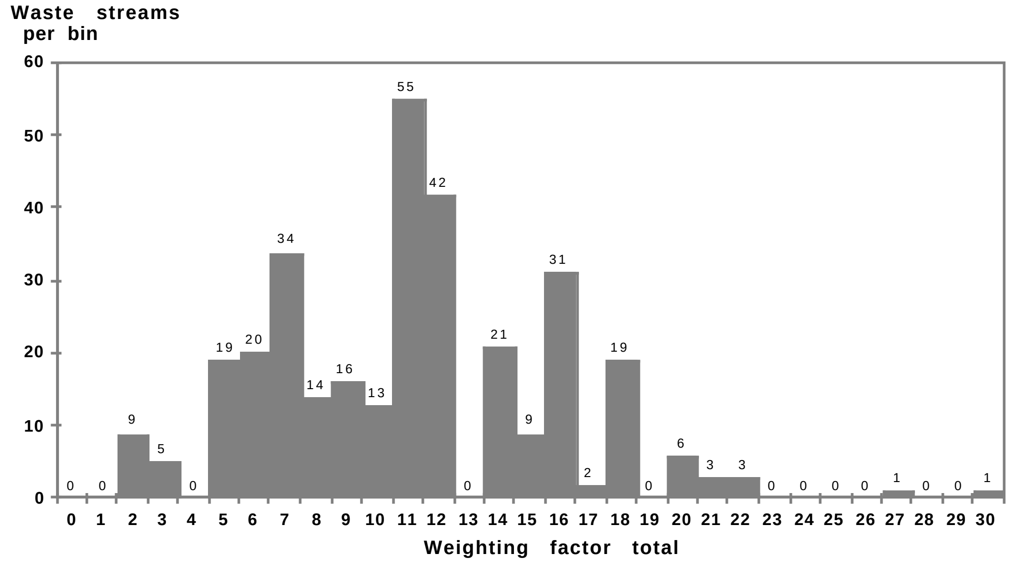

Figure 2. Waste streams histogram showing weighting factor results.

Table 23. Assigned values for the quantity factor.

Criteria (lb)	Factor
0 to 500	0.01
501 to 1,000	0.1
1,001 to 5,000	1.0
5,001 to 35,000	5
35,001 and above	10

Table 24. Assigned values for the cost factor.

Criteria	Factor
Sewered	0.001
Nonhazardous	0.1
LLW/CA	0.5
Rad	0.5
RCRA	1
DTSC	1
TSCA	1
Mixed	5
Mixed TSCA	5
TRU	10
TRU mixed	10

Table 25. Assigned values for the waste type factor, including compliance and liability issues.

Criteria	Factor
Sewered	0.01
Nonhazardous	0.1
RCRA	5
DTSC	4
TSCA	4
LLW/CA	3
Rad	3
Mixed	7
Mixed TSCA	7
TRU	10
TRU mixed	10

Table 26. Assigned values for the operational factor.

Criteria	Factor
Nonroutine	1
Routine	5

For the current waste stream assessment, which uses the assigned weights in Tables 23 through 26, the maximum possible score is 35. TRU waste received the highest score of any LLNL waste stream, earning a total of 30 points. This value is, in large part, due to the weighting factor of 10 that was used for cost and the weighting factor of 10 for waste type to describe the TRU waste.

Those waste streams in the histogram with the highest scores should clearly receive more attention than ones with the lowest scores. The highest return on investment may be achieved with these waste streams. A great majority of LLNL's waste streams scored less than 50% of the total possible score, which suggests that they are not highly problematic even when the quantities are large. For example, LLNL has several large waste streams that can be sewered as a final means of disposal. Typically, these streams will not have a high return on investment compared to the others with higher scores. In contrast to LLNL, the profiles for the Hanford site or the Rocky Flats site, for example, could significantly differ in shape and total points due to the large quantities of hazardous, mixed, and TRU wastes that are generated.

This analysis can be used to prioritize pollution prevention efforts in the future. The ranked list is a better starting point for engineers or analysts when looking for source reduction opportunities, Their focus will be directed toward problematic waste streams, not the “low-value” but high-volume waste generators.

3.3 Limitations

Along with advantages of the new weighting-factor methodology are some limitations. In general these limitations also existed when waste generation is ranked solely by volume or quantity. The following considerations will affect the prioritization of LLNL waste streams for source reduction efforts:

1. No single methodology represents the final word on prioritization; any useful technique is simply a way to direct assessment efforts to the relevant sources and best options.
2. Efforts to minimize waste streams generated in small quantities may quickly reach a point of diminishing returns.
3. It is often useful to assess the waste generated from a particular building. A single process may generate different amounts and types of waste.
4. Air emissions are ignored by the weighting-factor methodology.
5. The cost to implement certain changes may be high. Cost is unknown until a process is evaluated.
6. Mixed and radioactive wastes are usually generated from weapons-related work or biological research projects. Changes or substitutions may not be possible in certain cases, or the weapons certification process may be to costly.
7. Some research and development activities have a limited lifetime. In some instances, a process or activity may terminate before process improvements can be put into place.

3.4 Analysis of Top 20 Waste Streams Using Weighting Factors

The following discussion is a more detailed analysis of the newly ranked top 20 LLNL waste streams for CY 1995. Appendix C provides a complete list of all the LLNL source code components, in decreasing order, by weighting factor total points.

3.4.1 TRU/TRU Mixed Routine Waste

Rank Number 1

TRU wastes are not tracked in the same database as other LLNL wastes and do not have an assigned source code. Thus, these wastes do not appear on the list of the top 20 LLNL waste streams by quantity (Section 2 of this report). In contrast, the weighting factor analysis shows that TRU waste should be a priority for waste minimization.

This waste stream is generated at LLNL in support of the DOE Stockpile Stewardship and Management Program. Every workstation (i.e., glovebox) in B332 operates within the boundaries of a Process Knowledge Evaluation (PKE) prior to the startup of work. The PKE ensures that only approved materials and processes will be used in this building.

The characterization and repacking of TRU legacy waste will continue for the foreseeable future. Legacy waste must be recharacterized and repacked to meet the Waste Isolation Pilot Plant (WIPP) waste acceptance criteria. The legacy waste program will generate new waste that includes sampling and analysis, protective clothing, empty drums, and equipment. The projected waste generation through the year 2000 is estimated at about 8 tons per year. LLNL will conduct R&D experiments related to the Stockpile Stewardship and Management Program for the foreseeable future as well.

The PPG has funded pollution prevention opportunity assessments (PPOAs) in this area during FY 1995 and FY 1996. An option to eliminate the generation of mixed waste has been identified in the machining of plutonium. A nonhazardous alternative to TCE is being beta tested for 3M Corp. This alternative was also discussed in the context of the machining operations waste stream (see Section 2). The new fluid, which will be used as a cutting fluid in the machining operation, is now commercially available. LLNL has been conducting compatibility studies for more than 6 months; at present, this alternative appears to be an attractive replacement for TCE and PCE. Toxicity testing of the commercial product is necessary to ensure that this replacement fluid is not hazardous.

The following projects are related to the Stockpile Stewardship and Management Program with the goal of reducing future TRU waste generation and, at the same time, achieving LLNL’s programmatic goals and objectives.

Plutonium Die Casting

LLNL is developing and demonstrating a plutonium die casting process that results in large reductions in radioactive waste generation, recycled plutonium scrap, and worker radiation exposure. The DOE's plans call for LLNL to complete development of the process in mid-FY 1997 and to be closely involved with transferring it to LANL to benefit future pit manufacturing late in FY 1997.

Improved Dismantlement Process

LLNL is designing and demonstrating a bisector process module that generates minimum machining waste and provides reduced worker radiation exposure during pit dismantlement. A demonstration is planned in late FY 1997 at and with LANL.

Replacement Solvent

LLNL is developing and demonstrating the feasibility of using dimethyl sulphoxide (DMSO) as a substitute for a 50/50 acetone and dimethylformamide (DMF) solvent mixture to remove high explosives during weapon disassembly.

Improved Alloy Processing

LLNL is working to implement intelligent closed-loop processing controls on the LLNL spin-forming machine used to shape uranium alloys. This improvement will allow forming to near new shape, which will greatly reduce the volume of uranium and other wastes generated from existing processes.

Other Projects

A Contained Firing Facility is being constructed to replace an open air firing table at Site 300. The design of the new facility considers pollution prevention opportunities.

Research is also being conducted to explore the feasibility of using kinetic energy metalization to repair parts for potential reuse.

3.4.2 A940 Mixed Routine Waste (Laboratory Wastes)

Rank Number 2

According to the summary table, 47,886 lb of this waste were generated in CY 1995. The PPG discovered that the largest source for the A940 mixed waste was one requisition from Chemistry and Materials Science, namely a retention tank system in B151. The single requisition represented about 55%, or 26,150 lb, of this waste type. Further review by the environmental analysts showed that this waste was not mixed waste, that it was due to an off-normal event, and that the waste was usually sewerable.

The other large contributors to the waste stream were generated from environmental remediation activity and should not have been included as routine wastes, as defined by the DOE. This waste stream included ion-exchange resins and ion-exchange rinse water, which represented about 15, 275 lb, or 32%, of the total waste stream reported for this category. As discussed previously, waste from remediation activities is nonroutine by definition.

Other wastes included in this category are coolant from machine shops, mop water from machine shops, and other lab wastes from chemical analysis. LLNL is already working on reducing the coolant and mop water waste streams. The machine shop coolant and mop water waste appear in several different source codes. The PPG has been working with Plant Engineering to refurbish previously excessed equipment called a cold evaporator. The cold evaporator is currently being used to distill the mop water, separating the sludge and sewering the water. A portable metal analyzer unit is also being used to check the water to ensure that it meets sewer-discharge requirements without expensive sampling and analysis by outside labs.

3.4.3 A592 Mixed Routine Waste (Demolition/Decontamination)

Rank Number 3

By definition, all waste in this category is nonroutine. One incorrectly identified requisition in this category was from the Chemistry and Materials Science retention tank system in B151 (the conditions were the same as those discussed for the A940 mixed waste stream, below). This waste should have been coded as A940 instead of A592. This requisition represented 22,586 lb, or 90%, of the total waste in this category.

The remainder of the A592 mixed waste was spent aqueous waste from steam cleaning parts in B419 due to decontamination work.

3.4.4 A750 Mixed Routine Waste (Wastewater Treatment)

Rank Number 4

This waste is Dorr-Oliver filter cake residue from waste water treatment in B514. The B514 waste treatment is used to process liquid low-level and mixed waste. The water is separated from the other contaminants and is sewered. The remaining sludge is mixed with filter cake and is eventually stabilized for shipment to the Nevada Test Site for disposal as low-level waste.

HWM has purchased a cold evaporator system that does not use filter cake. This waste stream will be significantly reduced when the new system is on-line. The new cold evaporator system, which is to be installed in CY1997, performs the same separation of water from contaminants, however no filter cake is added. The sludge or residue from the cold evaporator will then be stabilized and shipped to Nevada for disposal. Because the filter cake is eliminated, the resultant stabilized waste will be significantly reduced.

3.4.5 A370 Mixed Routine Waste (Spent Process Liquids Removal)

Rank Number 5

Four requisitions from environmental remediation work related to ion-exchange rinse water should not have been included as routine waste. These requisitions represented a total of 13,280 lb, or 94% of the total waste in this category.

The remainder of the A370 mixed waste was spent machine shop coolant, which LLNL is already working to reduce.

Machining Coolant Wastes

Other machine shop coolant wastes generated in CY 1995 were reported under different source codes, specifically A940, A540, A494, and A491. Because these wastes have much in common, including the process that generated them, the process and recommended options are discussed here.

Process Description

Machine tool coolant and water are used in many machining operations throughout B32l, the main machine shop at LLNL. These fluids cool the work piece and tool during turning, milling, grinding, or shaping operations. TrimSol is the main coolant used in a 40:1 dilution ratio with water. This facility has in place a coolant recycling system (Xybex) for hazardous coolant waste and an evaporator for radioactive and mixed coolant waste.

Water-soluble cutting fluids can develop both bacterial and fugal problems. These problems can cause the fluid to become rancid, and solid fungal growths can block the fluid system. Once the fluid has developed such problems, fluid changes do not help because any residual fluid in a machine immediately contaminates the clean fluid. Occasionally, the entire recycling system becomes rancid, the system must be drained, and the fluid must be disposed.

Most machines in B321 use the recycler or evaporator for waste-reduction purposes. However, about 20 machines cannot use either system because of incompatibilities. These machines, and possibly the effluent from the recycling system, are the main contributors to this waste stream. Grinder fluids cannot be processed through the Xybex system due to fouling from epoxy contamination. TrimClear, a 100% synthetic, also contributes to the mixed waste portion of this waste stream. TrimClear is used for machining optics and ceramics where oil-based products cannot be used. TrimClear cannot be processed through the Xybex conditioner.

Recommended Options

1. Use synthetic fluids. Synthetic fluids do not have the organic decay problem of aqueous hydrocarbon fluids. The machine shop is currently experimenting with synthetic fluids in several machines. Fluid lifetimes are expected to reach 2 years without conditioning (Xybex.)
2. Use semisynthetic fluids. The main bay is experimenting with Dascool 2003, a semisynthetic fluid. This fluid has lasted over a year without conditioning (Xybex) in several different machines that have volumes ranging from 50 to 90 gallons. Dascool costs 30% more than TrimSol and is mixed in a l6:1 ratio with water. A phased-in approach would be used to convert to Dascool. As the TrimSol is spent and removed from the machines, Dascool will be added. ME/MMED management will assess the implementation logistics.
3. Recycle and dispose of Dascool off site. Clearwater Environmental Management company will pick up and recycle spent Dascool fluids for $2.05/gallon. A total cost assessment will be done by ME/MMED management to determine the practicality of this disposal method.
4. Use point-of-use filtering/tramp oil coalescing units on selective machines. It is common knowledge that particulate and tramp oil cause bacterial growth. Filtering, skimming, and aerating are techniques to extend the life of cutting fluids (synthetic, semisynthetic, or aqueous.) All main bay machine tools should be evaluated for the potential use of these techniques.

The PPG has experimented with a custom-fabricated point-of-use system with promising results. This system can be used with small sump volume, costs roughly $75 for parts, and the parts are available at local hardware stores.

3.4.6 Ethanol RCRA Routine Waste

Rank Number 6

Contaminated ethanol is a spent chemical that arises mainly from the dye laser used in the AVLIS process. A high-return-on-investment project for this waste stream was originally proposed in August 1995 and was eventually funded in May 1996. The process and proposed improvements are as follows.

Current Process and Waste

A copper and dye laser system designed to operate as a utility for various experiments, including isotope separation in B490, operates in B492. The dye amplifiers, which provide the necessary increase in power, consist of closed and pressurized flow channels through which dye dissolved in ethanol is circulated. When the dye eventually degrades, periodic draining and changeouts are required. The ethanol/dye amplification system must currently be changed 5 to 10 times per year.

At present, 10,000 gal per year of waste solution is generated. It is projected, however, that starting a year from now, the system will be operated 24 hr per day, 7 days a week, generating up to 120 gal per day (or 43,800 gal per year) of waste solution. The 10,000 gallons currently generated per year cost about $726,000 per year to manage.

Proposed Process and Waste

The used ethanol/dye solution is currently sent off site, where it is incinerated for its fuel value. This project proposes a system for recovering and reusing ethanol on-site through installation of a distillation system. Such an ethanol recovery system will quickly pay for itself and continue to provide large economic benefits over time.

The proposed project would reduce the ethanol waste stream by 9,500 to 41,610 gal per year, depending on facility production levels, and would result in only about 500 gal per year of waste. The associated waste management costs are projected to be reduced by $689,700. The waste management costs associated with operating an on-site unit are $36,300.

3.4.7 A600 RCRA Routine Waste (Sludge Removal)

Rank Number 7

The majority of this waste is generated by annual cleanout of the catch basins in LLNL cooling towers. A high-return-on-investment project was originally proposed in August 1995 and was eventually funded in October 1996.

Process Overview

Cooling towers (CTs) are the main source of heat rejection at LLNL (capacity is measured in tens of megawatts thermal). Many scientific experiments at LLNL require low conductivity water (LCW) for cooling purposes. CTs remove heat from LLNL's closed-loop LCW system through the use of heat exchangers. LLNL's cross-flow CTs operate by pumping municipal water (Hetch-Hetchy or Zone 7) into the CT catch basin. The water is pumped through heat exchangers and then to distribution boxes on top of the towers. The distribution boxes separate the water into small streams for distribution down the CT chevrons. Air is pulled through the chevrons / water streams by large fans atop the tower. As the water stream or particles drop down the chevrons, heat exchange occurs via evaporation. The system typically evaporates 90% of the water directly to the atmosphere. The remaining 10% is collected into a catch basin at the bottom of the tower, where it is held and automatically tested for pH and total dissolved solids (TDSs). Level sensing floats in the catch basin regulate the amount of municipal water intake pumped into the catch basin retention tanks, and the cycle may repeat.

If the TDSs measured in the catch basin water are less than 1500 parts per million (ppm), the water is cycled through the CT again. If the TDS are greater than 1500 ppm, the water is "blown down" or sewered, and additional water replenishes the system until the TDSs are within operational parameters. The proposed project is expected to increase the number of cycles through the CT, thus decreasing "blow down" and water usage.

As a consequence of continuous CT operation, routine maintenance practices have been developed by Plant Engineering. They have found that the CT catch basin periodically fills up with sludge and debris generated from normal operation. The catch basin sludge is generated from rust in water source pipes, dirt and metal particulates in the air trapped in cooling water at the chevrons and distribution boxes, and algae growth at the distribution boxes. Through years of experience, CT operators have established that proper CT operation requires the removal of catch basin sludge annually. The sludge cleanout must be continuously monitored by health and safety personnel to minimize the potential impact to workers.

Proposed ROI Project

This project proposes to minimize the waste generated from CT operation at LLNL by more than 90%. The present CT design allows sludge and toxic metals to concentrate in the bottom of the holding tank or catch basin. As sludge accumulates, heavy metals and particulates settle out of suspension to the bottom of the catch basin. The process concentrates heavy metals in the water to such an extent that the sludge buildup has been declared RCRA hazardous waste. A catch basin agitation system can be designed to keep particles in suspension, and the existing sand-pack filtering system can remove particulates before they are concentrated to hazardous levels. Filtered material (sediment and particulates) could then be routinely sewered.

However, the source of the CT sludge is dirt accumulated from the atmosphere, toxic metals believed to be from wood preservatives leaching into the water and airborne metals carried in the atmosphere, and dead algae from the distribution boxes located on top of the towers. By covering the distribution boxes and making them a “sealed” system, algae growth will be stopped or reduced, and a minimum of atmospheric contaminants (dirt and heavy metals associated with dirt) will be allowed into the system.

Covering or sealing the distribution boxes has been estimated to reduce the formation of algae by more than 50%. The reduction of algae has an added benefit: decreased amounts of treatment chemicals (algaecide and biocide) will be required to keep the system operating within acceptable parameters. These chemicals constitute a significant portion of CT operating expenses. Reducing algae growth alone is estimated to reduce operating costs (treatment chemical purchases) by approximately $29,000 per year.

The second part of the proposed project is to maintain the catch basin in an agitated state and to recirculate catch basin water through additional (new) sand filters. Dirt and trace metals will remain suspended in the water until they are removed by the filters. The sand filters will be backwashed using blowdown water from the cooling towers such that the concentration of trace metals will be at a low enough level that the backwashing water will be sewerable. This approach will prevent the buildup of metals and sludge in the catch basin.

Upgrading the CT facilities by sealing the distribution boxes will reduce the amount of hazardous (RCRA) sludge buildup by 90%, from approximately 28,636 to 2,864 kg per year (or from 63,000 to 6,300 lb per year). The anticipated annual RCRA waste reduction of 25,772 kg will result in a net annual savings of $847,920 per year in waste management costs, overhead (maintenance) costs, ES&H costs, water treatment chemical costs, and personnel training expenditures.

3.4.8 CFC-113 RCRA Routine Waste

Rank Number 7

The ozone-depleting CFCs in this waste stream are mainly spent chemicals from the atomic vapor laser isotope separation (AVLIS) process. The CFCs are used in the amplifiers as a dielectric coolant. The projected total quantity of CFCs for project startup in 1996 is 50,000 lb.

A high-return-on-investment project for this waste stream was originally proposed in August 1995 and was eventually funded in May 1996. The process and the proposed improvements are as follows.

Current Process and Waste

A copper and dye laser system designed to operate as a utility for various experiments, including isotope separation, operates in B490. High-voltage power supplies and pulsed-power electronic components in the 1985-design laser oscillators and amplifiers are immersed in CFC-113 for cooling and for preventing high-voltage discharge. The 1985 design components are expected to be in used well beyond the year 2000 and will continue to require CFC-113.

A copper laser amplifier or oscillator is completely self-contained. In the refurbishment process for those components immersed in CFC-113, CFC-113 is first removed from the components and chemically tested. If it meets specifications for reuse, it is stored in a 300-gal tank in the room until it can be reused. If the CFC is out of specification, it is pumped into a 3000-gal tank. At present, the 50,000 lb per year of generated waste costs about $700,000 per year to manage.

Proposed Process and Waste

Used CFC-113 is currently sent off site, where it is recycled. About 80% is sent back to LLNL. This project proposes a system for the onsite recovery and reuse of 95% of the CFC-113 through installation of a CFC purification unit. The proposed project would result in a reduction in CFC-113 as waste of 47,500lb per year, with associated reductions in waste management costs of $613,700. Waste management costs associated with operating an on-site unit for the proposed project are $36,300.

3.4.9 A310 DTSC Routine Waste (Product Rinsing)

Rank Number 9

More than 98% of this waste stream was generated at B865. This waste is contaminated with insulating oil from equipment in the building. The Advanced Test Accelerator (ATA) housed in this building is no longer used. The facility was shut down completely as of October 1995; therefore, no additional waste of this type will be routinely generated.

3.4.10 A491 DTSC Routine Waste (Machining/Welding Operations)

Rank Number 10

Routine DTSC waste for the A491 source code is machine shop coolant, previously discussed in section 3.4.5. The inclusion of the waste here illustrates the point that machine shop coolant is entered into the waste tracking database with several different source codes. PPG and HWM are working to improve the data consistency.

3.4.11 A592 DTSC Routine Waste (Demolition/Decontamination)

Rank Number 11

By definition, all A592 wastes are nonroutine. Fluorescent light bulbs and light ballasts are the largest of these individual wastes. The light conversion (i.e., re-lamping) activities are a site-wide conversion from old style ballasts to the newer electronic ballasts. The old bulbs are not compatible with the new ballasts. The used light bulbs are currently being taken to Donation, Utilization, and Sales for resale or give away as opposed to shipping them off site for mercury recycling. This one-time-only waste should have been identified as nonroutine.

3.4.12 A370 DTSC Routine Waste (Spent Process Liquids Removal)

Rank Number 12

The waste stream identified by the A370 source code was previously discussed in section 2.1.15. The portion identified as DTSC was oil removed from a transformer that was taken out of service. This portion of the waste should have been identified as nonroutine. The oil was shipped off site and reused as heating fuel.

3.4.13 A940 DTSC Routine Waste (Laboratory Wastes excluding biomedical)

Rank Number 13

The major contributor to this waste stream is spent ethanol from the dye laser operation in the isotope separation system. The waste stream and the currently funded ROI project are discussed in section 3.4.6. Furthermore, this waste should have been identified as A370 Spent Process Liquids Removal.

3.4.14 A540 DTSC Routine Waste (Oil Changes—Maintenance)

Rank Number 14

The DTSC routine waste is spent oil from the motor pool and heavy equipment. The oil is currently shipped off site for recycling. This waste has been reduced in the heavy equipment area by using an oil analyzer to determine when oil needs to be changed instead of using a typical time period, hours of operation, or the number of miles as criteria. The motor pool has started to use re-refined oil, which closes the loop for this waste stream. At present, no further reduction options are being pursued.

3.4.15 A560 Mixed Nonroutine Waste (Discontinued Use of Process Equipment)

Rank Number 15

This source code has been changed to A562 to clearly identify it as a nonroutine waste. Each piece of equipment is evaluated for reuse or recycling opportunities. This mixed waste was rinsewater generated from the decontamination and closure of the B819 steam pad. Alternatives, such as CO_2, were considered to be unacceptable because they were not aggressive enough to perform the decontamination. Steam cleaning was the only acceptable technology in this closure activity. Such activities are reviewed on a case-by-case basis.

3.4.16 A610 Mixed Nonroutine Waste (Superfund Remedial Action)

Rank Number 16

This source code has been changed to A612 to clearly identify it as a nonroutine waste. The waste is generated when ground water is remediated, and the ion exchange resin is spent. The backwashing of the ion resin generates a mixed waste consisting of water, spent acid, and spent inorganic solids. PPG is working with the Environmental Remediation Division (ERD) and HWM to understand why this waste has been identified as mixed and to consider alternatives to the current practices.

3.4.17 A494 Mixed Routine Waste (Cooling Processes)

Rank Number 17

This waste stream was entirely due to the machine shop coolant at B321. LLNL is proactively working on this waste, and it has been a Performance Measure waste stream for several years. The same type of waste is also reported in other source codes. This is a continuing problem for the PPG to track and report. The PPG is training the generators and others who fill out requisitions to achieve more consistency in characterizing waste by source codes. A detailed discussion of machine shop coolant is presented in A370 (see rank number 5, section 3.4.5, above).

3.4.18 A792 Mixed Routine Waste (Asbestos Removal/Abatement)

Rank Number 18

All waste in this category is, by definition, nonroutine. However during CY 1995, when the PPG and HWM redefined the LLNL source codes, asbestos removal/abatement was previously A791, whereas A792 was waste analysis (i.e., samples). In fact, none of the waste reported in this category was generated from asbestos removal or abatement. For this report, most of the waste listed within A792 was generated by the Chemistry and Materials Science (C&MS) Directorate's environmental analysis laboratory. This waste is the result of sampling and analysis performed by that laboratory.

The C&MS department uses various analytical techniques to determine material properties for the programs at LLNL. Samples of materials are sent to C&MS from programs throughout LLNL for analysis. Often these analytical samples are disposed of as mixed waste unless their identity is otherwise known. C&MS uses this conservative approach rather than spending time and money in evaluating sample data and then determining the waste classification for segregation.

Recommended Options

1. Implement a sample tracking and segregation system. Software has been developed by C&MS to track samples as they are processed through various analytical techniques. This software also contains the data necessary to determine waste classification. Funding is needed to implement and support this system. The potential quantity of mixed waste reduction from C&MS is unknown but is assumed to be significant.

2. Use microscale chemistry. C&MS has proposed an evaluation of microscale chemistry for applicability to LLNL and benchmarking data from other DOE sites. The potential quantity of mixed waste reduction (and the reduction of other waste types) from C&MS is unknown but is assumed to be significant.

3.4.19 A540 Mixed Routine Waste (Oil Changes—Maintenance)

Rank Number 19

All of the waste reported in this category was TrimSol machine coolant, previously discussed in section 3.4.5. Machine shop coolant is entered into the waste tracking database with several different source codes. PPG is addressing this matter as a training issue with HWM.

3.4.20 A793 Mixed Routine Waste (Waste Analysis, i.e., Samples)

Rank Number 20

Most of this waste was generated by the C&MS Directorate's analytical laboratory as a result of processing and analyzing samples, as described under source code A792, above. However 747 lb, or 57%, of the total reported in this category was generated by remediation activities at LLNL. This included aqueous acid waste samples and ground water from bore sampling. The remediation waste should be identified as nonroutine.

3.5 Conclusions

The weighting factor approach for waste stream prioritization, which is presented in this report, is a good first step for identifying problematic waste streams. On the one hand, it represents a far more focused assessment because it takes into account specific waste stream components rather than an entire source code, which usually consists of many different siblings. Conversely, the new methodology incorporates a far broader range of relevant parameters, compared to the previous ranking based exclusively on the total quantity of waste associated with each source code.

The specific components of the newly ranked top 20 waste streams are substantively different from those on the former ranked list in that they include problematic wastes at LLNL. At the top of the new list are TRU and mixed waste types, which are considered problematic in that the nation lacks the capability to treat and dispose of these waste types. They also require significant certification programs and pose special handling and storage problems. All of these streams were originally identified in the database as routine wastes at LLNL; however, after addition evaluation, some had been properly identified whereas others where found to be nonroutine.

Two other important waste streams that appear on the new list are ozone-depleting CFCs (rank number 7) and contaminated ethanol (rank number 8). Both of these RCRA routine waste streams, which are spent chemicals from the AVLIS process, are high-return-on-investment recycling projects that the DOE has approved in principle.

Overall, the weighting factor method is a vast improvement over the former method used to prioritize LLNL wastes. The new method identifies problematic waste by source code, waste type, and its routine/nonroutine characteristics, thus making more information immediately available to analysts when looking for source reduction opportunities. Furthermore, the specific values assigned as weighting factors can readily be changed to test new assumptions and to generate revised rankings as a function of those assumptions. Finally, the data set from which the rankings in this report were generated contained more than 10,000 individual entries. Using a histogram (such as that in Figure 2) to summarize and display such massive amounts of data—expressed as the sum of the weighting factors for each entry and the relative distribution of total points—allows the results to become immediately visible and far more amenable to interpretation.

Appendix A

LLNL Waste Source Codes

Cleaning/Degreasing Operations

A010	Stripping
A020	Acid cleaning
A030	Caustic (alkali) cleaning
A040	Flush rinsing
A050	Dip rinsing
A060	Spray rinsing
A070	Vapor degreasing
A080	Physical scraping and removal
A090	Clean out process equipment
A092	Non-routine clean out process equipment
A191	Cleaning with solvents
A193	Steam cleaning operation

Surface Preparation/Finishing

A210	Painting
A220	Electroplating
A230	Electroless plating
A240	Phosphating
A250	Heat treating
A260	Pickling
A270	Etching
A293	Abrasives blasting operations
A294	Grinding / polishing operations

Other Processes

A310	Product rinsing
A320	Product filtering
A330	Product distillation
A340	Product solvent extraction
A350	By-product processing
A360	Spent catalyst removal
A362	Non-routine spent catalyst removal
A370	Spent process liquids removal (electroplating caustics)
A372	Non-routine spent process liquids removal
A380	Tank sludge removal

A382 Non-routine tank sludge removal

A390 Slag removal

A400 Metal forming

A410 Plastics forming

A491 Machining / welding operations (chips or solids)

A492 Building construction / renovation / reroofing (bldg. mat & soils)

A493 Gardening operations (fertilizer / pesticide application)

A494 Cooling processes (liquids i.e., Trimsol from machining operations)

A495 Cooling tower (regeneration of water deionizers)

A496 Photo developing / printing / copy machine / x ray

A497 Explosives testing

A498 Microchip processing

A499 Building maintenance

One-Time and Intermittent Processes

A512 Non-routine leak collection

A532 Non-routine cleanup of spill residues

A540 Oil changes—maintenance

A542 Non-routine oil changes

A550 Filter / battery replacement

A562 Discontinued use of process equipment

A572 Discarding off-spec material

A582 Discarding unused, out-of-date products or chemicals

A591 Freon recharging

A592 Demolition / decontamination / equipment decommissioning (bldg. or equipment)

A593 Equipment maintenance operations

A594 Hospital / medical procedures

A595 Discarding empty containers

A596 Emptying retention tanks

A600 Sludge removal

A602 Non-routine sludge removal

Remediation Derived Waste

A612 Superfund remedial action

A622 Superfund emergency response

A632 RCRA corrective action at solid waste management unit

A642 RCRA closure of hazardous waste management unit

A652 Storage tank cleanup (under or above ground)

A692 Other remediation

Pollution Control or Waste Treatment

A710 Filtering / screening

A720 Metals recovery

A730 Solvents recovery

A740 Incineration / thermal treatment

A750 Wastewater treatment

A760 Sludge dewatering

A770 Stabilization

A780 Air pollution control devices

A790 Leachate collection

A792 Asbestos removal / abatement

A793 Waste analysis (i.e., samples)

A794 Berm water collection

Miscellaneous Activities

A910 Clothing and personal protective equipment

A920 Routine cleanup wastes (i.e., floor sweepings)

A932 Closure of management unit(s) or equipment other than by remediation (WAA's, RMMA's)

A940 Laboratory wastes (excluding biomedical) (i.e., spent solutions, lab trash, etc.)

A942 Non-routine laboratory wastes (i.e., close-out for lab solutions)

A943 Biomedical laboratory waste (i.e., spent solutions, lab trash, etc.)

A990 Other

A992 Non-routine other

Appendix B

Source Code Listing of CY 1995 Wastes Sorted According to Total Quantity Generated in Decreasing Order

Source code	Description	Routine (lb)	Non routine (lb)	Total (lb)	% of total	% Cum. of total
A793	Waste analysis (i.e., samples)	687,583	—	687,583	18	18
A492	Building construction/renovation	—	467,114	467,114	12	30
A592	Demolition/decontamination	76,313	326,458	402,771	11	41
A940	Laboratory wastes (excluding biomedical) (i.e., spent solutions, lab trash, etc.)	223,648	1,148	224,796	6	46
A596	Emptying retention tanks	185,855	—	185,855	5	51
A510	Building maintenance	—	176,928	176,928	5	56
A750	Wastewater treatment	168,486	977	169,463	4	60
A560	Discontinued use of process equipment	—	119,693	119,693	3	63
A593	Equipment maintenance operations	11,553	98,466	110,020	3	66
A491	Machining/welding operations	109,502	—	109,502	3	69
A310	Product rinsing	103,460	—	103,460	3	72
A794	Berm water collection	99,994	—	99,994	3	75
A540	Oil changes-maintenance	63,377	35,790	99,167	3	77
A494	Cooling processes (machine/computer, etc.)	98,499	—	98,499	3	80
A370	Spent process liquids removal	79,224	—	79,224	2	82
A530	Nonroutine leak collection	—	65,948	65,948	2	83
A090	Clean out process equipment	55,257	374	55,631	1	85
A600	Sludge removal	54,689	—	54,689	1	86
A192	Steam cleaning operation	51,792	—	51,792	1	88
A791	Asbestos removal/abatement	20,600	19,600	40,200	1	89
A496	Photo developing/printing/copy machine/ x-ray	39,010	126	39,136	1	90
A610	Superfund remedial action	—	35,987	35,987	1	91
A570	Discarding off-spec material	29,126	3,747	32,873	1	92
A562	Discontinued use of process equipment	—	25,962	25,962	1	92
A191	Cleaning with solvents	24,533	10	24,543	1	93
A497	Explosives testing	23,146	274	23,420	1	93
A010	Shipping	23,279	—	23,279	1	94
A992	Nonroutine other	—	20,000	20,000	1	95
A580	Discarding off-spec material	17,897	38	17,935	0	95
A941	Biomedical laboratory waste (i.e., spent solutions, lab trash, etc.)	17,305	41	17,346	0	96
A040	Flush rinsing	14,351	—	14,351	0	96
A550	Filter/battery replacement	14,255	88	14,343	0	96
A210	Painting	13,741	—	13,741	0	97

Source code	Description	Routine (lb)	Non routine (lb)	Total (lb)	% of total	% Cum. of total
A792	Asbestos removal/abatement	5,729	6,995	12,724	0	97
A990	Other	11,021	25	11,046	0	97
A498	Microchip processing	10,974	8	10,982	0	98
A293	Abrasives blasting operations	9,460	—	9,460	0	98
A595	Discarding empty containers	8,776	2	8,778	0	98
A060	Spray rinsing	8,145	—	8,145	0	98
A790	Leachate collection	6,640	—	6,640	0	98
A495	Cooling tower (regeneration of water deionizers)	6,250	—	6,250	0	99
A780	Air pollution control devices	6,116	—	6,116	0	99
A920	Routine cleanup wastes (e.g., floor sewerage)	5,573	1	5,573	0	99
A650	RCRA closure of hazardous waste management unit	—	5,300	5,300	0	99
A350	Byproduct processing	3,534	—	3,534	0	99
A930	Closure of management unit(s) or equipment other than by remediation	—	3,420	3,420	0	99
A080	Physical scraping and removal	3,110	—	3,110	0	99
A390	Slag removal	2,858	—	2,858	0	99
A652	Underground storage tank cleanup	—	2,832	2,832	0	99
A230	Electroless plating	2,121	—	2,121	0	99
A030	Caustic (alkali) cleaning	2,118	—	2,118	0	100
A270	Etching	2,107	—	2,107	0	100
A943	Biomedical laboratory waste (i.e., spent solutions, lab trash, etc.)	1,914	—	1,914	0	100
A292	Grinding/polishing operations	1,909	—	1,909	0	100
A020	Acid cleaning	1,371	—	1,371	0	100
A582	Discarding out-of-date products or chemicals	—	1,299	1,299	0	100
A710	Filtering/screening	1,157	—	1,157	0	100
A499	Building maintenance	913	—	913	0	100
A910	Clothing and personal protective equipment	843	—	843	0	100
A612	Superfund remedial action	—	785	785	0	100
A602	Nonroutine sludge removal	—	750	750	0	100
A720	Metals recovery	654	—	654	0	100
A532	Spill cleanup	—	611	611	0	100
A380	Tank sludge removal	443	—	443	0	100
Source code	Description	Routine (lb)	Non routine (lb)	Total (lb)	% of total	% Cum. of total
A330	Product distillation	423	—	423	0	100

A294	Grinding/polishing operations	416	—	416	0	100
A932	Closure of management unit(s) or equipment other than by remediation	—	397	397	0	100
A291	Sanding operations	332	—	332	0	100
A340	Product solvent extraction	305	—	305	0	100
A594	Hospital/medical procedures	286	—	286	0	100
A572	Discarding off-spec material	—	179	179	0	100
A320	Product filtering	171	—	171	0	100
A410	Plastics forming	139	9	148	0	100
A730	Solvents recovery	87	—	87	0	100
A050	Dip rinsing	76	—	76	0	100
A740	Incineration/thermal treatment	70	—	70	0	100
A220	Electroplating	58	—	58	0	100
A070	Vapor degreasing	42	—	42	0	100
A400	Metal forming	17	—	17	0	100
A250	Heat treating	7	—	7	0	100
		Grand total		**3,834,018**	**100**	

Appendix C

Source Code Listing of CY1995 Wastes Sorted According to Weighting Factors in Decreasing Order

Waste description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
Source Code: TRU/TRU Mixed Routine	21,600	5	10	10	5	30
Source Code: A940 Mixed Routine	47,886	10	5	7	5	27
Source Code: A370 Mixed Routine	14,152	5	5	7	5	22
Source Code: A592 Mixed Routine	25,076	5	5	7	5	22
Source Code: A750 Mixed Routine	18,931	5	5	7	5	22
Source Code: A600 RCRA Routine	51,063	10	1	5	5	21
Source Code: CFC 113 recycling ROI project RCRA Routine	50,000	10	1	5	5	21
Source Code: Ethanol recycling ROI project RCRA Routine	310,250	10	1	5	5	21
Source Code: A310 DTSC Routine	102,588	10	1	4	5	20
Source Code: A370 DTSC Routine	43,326	10	1	4	5	20
Source Code: A491 DTSC Routine	53,426	10	1	4	5	20
Source Code: A540 DTSC Routine	35,473	10	1	4	5	20
Source Code: A592 DTSC Routine	44,150	10	1	4	5	20
Source Code: A940 DTSC Routine	36,562	10	1	4	5	20
Source Code: A494 Mixed Routine	4,980	1	5	7	5	18
Source Code: A540 Mixed Routine	1,331	1	5	7	5	18
Source Code: A792 Mixed Routine	3,103	1	5	7	5	18
Source Code: A793 Mixed Routine	1,301	1	5	7	5	18
Source Code: A560 Mixed Nonroutine	10,523	5	5	7	1	18
Source Code: A610 Mixed Nonroutine	6,873	5	5	7	1	18
Source Code: A491 Mixed Routine	910	0.1	5	7	5	17
Source Code: A941 Mixed Routine	660	0.1	5	7	5	17
Source Code: A010 Mixed Routine	498	0.01	5	7	5	17
Source Code: A020 Mixed Routine	228	0.01	5	7	5	17
Source Code: A050 Mixed Routine	25	0.01	5	7	5	17
Source Code: A191 Mixed Routine	374	0.01	5	7	5	17
Source Code: A270 Mixed Routine	17	0.01	5	7	5	17
Source Code: A292 Mixed Routine	134	0.01	5	7	5	17
Source Code: A497 Mixed Routine	110	0.01	5	7	5	17
Source Code: A550 Mixed Routine	150	0.01	5	7	5	17
Source Code: A580 Mixed Routine	12	0.01	5	7	5	17
Source Code: A596 Mixed Routine	208	0.01	5	7	5	17
Source Code: A943 Mixed Routine	42	0.01	5	7	5	17

Waste description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
Source Code: A492 RCRA Nonroutine	456,674	10	1	5	1	17
Source Code: A592 RCRA Nonroutine	310,257	10	1	5	1	17
Source Code: A090 RCRA Routine	30,699	5	1	5	5	16
Source Code: A191 RCRA Routine	19,838	5	1	5	5	16
Source Code: A192 RCRA Routine	13,944	5	1	5	5	16
Source Code: A210 RCRA Routine	5,644	5	1	5	5	16
Source Code: A293 RCRA Routine	9,111	5	1	5	5	16
Source Code: A370 RCRA Routine	9,558	5	1	5	5	16
Source Code: A491 RCRA Routine	12,288	5	1	5	5	16
Source Code: A495 RCRA Routine	6,250	5	1	5	5	16
Source Code: A496 RCRA Routine	30,685	5	1	5	5	16
Source Code: A540 RCRA Routine	25,803	5	1	5	5	16
Source Code: A550 RCRA Routine	8,736	5	1	5	5	16
Source Code: A570 RCRA Routine	5,211	5	1	5	5	16
Source Code: A580 RCRA Routine	6,254	5	1	5	5	16
Source Code: A940 RCRA Routine	32,461	5	1	5	5	16
Source Code: A530 DTSC Nonroutine	44,543	10	1	4	1	16
Source Code: A540 TSCA Nonroutine	35,790	10	1	4	1	16
Source Code: A560 DTSC Nonroutine	40,725	10	1	4	1	16
Source Code: A560 TSCA Nonroutine	54,164	10	1	4	1	16
Source Code: A593 DTSC Nonroutine	46,471	10	1	4	1	16
Source Code: A593 TSCA Nonroutine	42,300	10	1	4	1	16
Source Code: A491 Nonhazardous Routine	36,845	10	0.1	0.1	5	15
Source Code: A494 Nonhazardous Routine	42,289	10	0.1	0.1	5	15
Source Code: A596 Nonhazardous Routine	36,079	10	0.1	0.1	5	15
Source Code: A750 Nonhazardous Routine	74,185	10	0.1	0.1	5	15
Source Code: A192 Sewered Routine	37,433	10	0.001	0.001	5	15
Source Code: A494 Sewered Routine	41,501	10	0.001	0.001	5	15
Source Code: A596 Sewered Routine	139,474	10	0.001	0.001	5	15
Source Code: A750 Sewered Routine	60,590	10	0.001	0.001	5	15
Source Code: A793 Sewered Routine	683,127	10	0.001	0.001	5	15
Source Code: A794 Sewered Routine	99,994	10	0.001	0.001	5	15
Source Code: A940 Sewered Routine	45,443	10	0.001	0.001	5	15
Source Code: A210 DTSC Routine	8,097	5	1	4	5	15
Source Code: A494 DTSC Routine	5,690	5	1	4	5	15

Waste description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
Source Code: A496 DTSC Routine	8,043	5	1	4	5	15
Source Code: A570 DTSC Routine	23,864	5	1	4	5	15
Source Code: A580 DTSC Routine	11,515	5	1	4	5	15
Source Code: A593 DTSC Routine	6,314	5	1	4	5	15
Source Code: A596 DTSC Routine	5,055	5	1	4	5	15
Source Code: A791 DTSC Routine	11,800	5	1	4	5	15
Source Code: A941 DTSC Routine	6,647	5	1	4	5	15
Source Code: A652 Mixed Nonroutine	2,832	1	5	7	1	14
Source Code: A792 Mixed Nonroutine	1,773	1	5	7	1	14
Source Code: A090 Rad Routine	16,185	5	0.5	3	5	14
Source Code: A750 LLW/CA Routine	10,338	5	0.5	3	5	14
Source Code: A940 LLW/CA Routine	9,755	5	0.5	3	5	14
Source Code: A940 Rad Routine	26,901	5	0.5	3	5	14
Source Code: A593 Mixed Nonroutine	655	0.1	5	7	1	13
Source Code: A612 Mixed Nonroutine	504	0.1	5	7	1	13
Source Code: A530 Mixed TSCA Nonroutine	148	0.01	5	7	1	13
Source Code: A532 Mixed Nonroutine	4	0.01	5	7	1	13
Source Code: A562 Mixed Nonroutine	50	0.01	5	7	1	13
Source Code: A562 Mixed TSCA Nonroutine	90	0.01	5	7	1	13
Source Code: A572 Mixed Nonroutine	0	0.01	5	7	1	13
Source Code: A593 Mixed TSCA Nonroutine	386	0.01	5	7	1	13
Source Code: A595 Mixed TSCA Nonroutine	2	0.01	5	7	1	13
Source Code: A750 Mixed Nonroutine	90	0.01	5	7	1	13
Source Code: A792 Mixed TSCA Nonroutine	44	0.01	5	7	1	13
Source Code: A932 Mixed Nonroutine	291	0.01	5	7	1	13
Source Code: A940 Mixed Nonroutine	50	0.01	5	7	1	13
Source Code: A940 Mixed TSCA Nonroutine	72	0.01	5	7	1	13
Source Code: A941 Mixed TSCA Nonroutine	17	0.01	5	7	1	13
Source Code: A020 RCRA Routine	1,098	1	1	5	5	12
Source Code: A270 RCRA Routine	1,966	1	1	5	5	12
Source Code: A292 RCRA Routine	1,706	1	1	5	5	12
Source Code: A390 RCRA Routine	2,858	1	1	5	5	12
Source Code: A497 RCRA Routine	1,283	1	1	5	5	12
Source Code: A498 RCRA Routine	1,820	1	1	5	5	12
Source Code: A592 RCRA Routine	3,625	1	1	5	5	12

Waste description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
Source Code: A596 RCRA Routine	4,980	1	1	5	5	12
Source Code: A750 RCRA Routine	3,977	1	1	5	5	12
Source Code: A941 RCRA Routine	2,450	1	1	5	5	12
Source Code: A560 RCRA Nonroutine	13,676	5	1	5	1	12
Source Code: A610 RCRA Nonroutine	12,242	5	1	5	1	12
Source Code: A030 RCRA Routine	785	0.1	1	5	5	11
Source Code: A040 RCRA Routine	996	0.1	1	5	5	11
Source Code: A310 RCRA Routine	872	0.1	1	5	5	11
Source Code: A593 RCRA Routine	623	0.1	1	5	5	11
Source Code: A792 RCRA Routine	884	0.1	1	5	5	11
Source Code: A920 RCRA Routine	840	0.1	1	5	5	11
Source Code: A943 RCRA Routine	626	0.1	1	5	5	11
Source Code: A010 RCRA Routine	55	0.01	1	5	5	11
Source Code: A050 RCRA Routine	51	0.01	1	5	5	11
Source Code: A070 RCRA Routine	42	0.01	1	5	5	11
Source Code: A080 RCRA Routine	55	0.01	1	5	5	11
Source Code: A230 RCRA Routine	4	0.01	1	5	5	11
Source Code: A291 RCRA Routine	332	0.01	1	5	5	11
Source Code: A294 RCRA Routine	0	0.01	1	5	5	11
Source Code: A320 RCRA Routine	49	0.01	1	5	5	11
Source Code: A330 RCRA Routine	242	0.01	1	5	5	11
Source Code: A340 RCRA Routine	264	0.01	1	5	5	11
Source Code: A350 RCRA Routine	109	0.01	1	5	5	11
Source Code: A380 RCRA Routine	443	0.01	1	5	5	11
Source Code: A410 RCRA Routine	88	0.01	1	5	5	11
Source Code: A494 RCRA Routine	67	0.01	1	5	5	11
Source Code: A595 RCRA Routine	177	0.01	1	5	5	11
Source Code: A720 RCRA Routine	454	0.01	1	5	5	11
Source Code: A730 RCRA Routine	87	0.01	1	5	5	11
Source Code: A740 RCRA Routine	5	0.01	1	5	5	11
Source Code: A780 RCRA Routine	292	0.01	1	5	5	11
Source Code: A793 RCRA Routine	370	0.01	1	5	5	11
Source Code: A910 RCRA Routine	20	0.01	1	5	5	11
Source Code: A990 RCRA Routine	227	0.01	1	5	5	11
Source Code: A510 Sewered Nonroutine	148,363	10	0.001	0.001	1	11

Waste description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
Source Code: A030 DTSC Routine	1,333	1	1	4	5	11
Source Code: A040 DTSC Routine	1,984	1	1	4	5	11
Source Code: A090 DTSC Routine	2,301	1	1	4	5	11
Source Code: A230 DTSC Routine	2,117	1	1	4	5	11
Source Code: A350 DTSC Routine	2,762	1	1	4	5	11
Source Code: A497 DTSC Routine	1,004	1	1	4	5	11
Source Code: A550 DTSC Routine	4,012	1	1	4	5	11
Source Code: A595 DTSC Routine	4,682	1	1	4	5	11
Source Code: A600 DTSC Routine	1,966	1	1	4	5	11
Source Code: A920 DTSC Routine	2,104	1	1	4	5	11
Source Code: A492 DTSC Nonroutine	8,493	5	1	4	1	11
Source Code: A510 DTSC Nonroutine	27,064	5	1	4	1	11
Source Code: A562 DTSC Nonroutine	22,768	5	1	4	1	11
Source Code: A610 DTSC Nonroutine	8,079	5	1	4	1	11
Source Code: A650 DTSC Nonroutine	5,300	5	1	4	1	11
Source Code: A791 TSCA Nonroutine	19,600	5	1	4	1	11
Source Code: A010 Nonhazardous Routine	22,269	5	0.1	0.1	5	10
Source Code: A790 Nonhazardous Routine	5,395	5	0.1	0.1	5	10
Source Code: A791 Nonhazardous Routine	8,800	5	0.1	0.1	5	10
Source Code: A940 Nonhazardous Routine	24,640	5	0.1	0.1	5	10
Source Code: A499 DTSC Routine	913	0.1	1	4	5	10
Source Code: A710 DTSC Routine	702	0.1	1	4	5	10
Source Code: A792 DTSC Routine	862	0.1	1	4	5	10
Source Code: A910 DTSC Routine	823	0.1	1	4	5	10
Source Code: A943 DTSC Routine	794	0.1	1	4	5	10
Source Code: A010 DTSC Routine	42	0.01	1	4	5	10
Source Code: A020 DTSC Routine	45	0.01	1	4	5	10
Source Code: A060 DTSC Routine	426	0.01	1	4	5	10
Source Code: A080 DTSC Routine	105	0.01	1	4	5	10
Source Code: A191 DTSC Routine	171	0.01	1	4	5	10
Source Code: A192 DTSC Routine	415	0.01	1	4	5	10
Source Code: A220 DTSC Routine	58	0.01	1	4	5	10
Source Code: A250 DTSC Routine	7	0.01	1	4	5	10
Source Code: A270 DTSC Routine	125	0.01	1	4	5	10
Source Code: A292 DTSC Routine	64	0.01	1	4	5	10

Waste description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
Source Code: A293 DTSC Routine	261	0.01	1	4	5	10
Source Code: A294 DTSC Routine	415	0.01	1	4	5	10
Source Code: A320 DTSC Routine	120	0.01	1	4	5	10
Source Code: A330 DTSC Routine	181	0.01	1	4	5	10
Source Code: A340 DTSC Routine	42	0.01	1	4	5	10
Source Code: A400 DTSC Routine	7	0.01	1	4	5	10
Source Code: A410 DTSC Routine	51	0.01	1	4	5	10
Source Code: A498 DTSC Routine	415	0.01	1	4	5	10
Source Code: A720 DTSC Routine	200	0.01	1	4	5	10
Source Code: A750 DTSC Routine	465	0.01	1	4	5	10
Source Code: A780 DTSC Routine	5	0.01	1	4	5	10
Source Code: A793 DTSC Routine	4	0.01	1	4	5	10
Source Code: A990 DTSC Routine	20	0.01	1	4	5	10
Source Code: A040 Sewered Routine	10,417	5	0.001	0.001	5	10
Source Code: A060 Sewered Routine	7,719	5	0.001	0.001	5	10
Source Code: A090 Sewered Routine	5,499	5	0.001	0.001	5	10
Source Code: A370 Sewered Routine	6,296	5	0.001	0.001	5	10
Source Code: A497 Sewered Routine	20,750	5	0.001	0.001	5	10
Source Code: A498 Sewered Routine	6,250	5	0.001	0.001	5	10
Source Code: A990 Sewered Routine	10,168	5	0.001	0.001	5	10
Source Code: A080 Rad Routine	2,950	1	0.5	3	5	10
Source Code: A191 Rad Routine	4,150	1	0.5	3	5	10
Source Code: A370 Rad Routine	4,524	1	0.5	3	5	10
Source Code: A491 LLW/CA Routine	3,698	1	0.5	3	5	10
Source Code: A491 Rad Routine	2,334	1	0.5	3	5	10
Source Code: A494 LLW/CA Routine	3,973	1	0.5	3	5	10
Source Code: A550 Rad Routine	1,255	1	0.5	3	5	10
Source Code: A592 Rad Routine	2,530	1	0.5	3	5	10
Source Code: A920 Rad Routine	1,990	1	0.5	3	5	10
Source Code: A941 LLW/CA Routine	3,056	1	0.5	3	5	10
Source Code: A941 Rad Routine	3,965	1	0.5	3	5	10
Source Code: A592 Rad Nonroutine	12,025	5	0.5	3	1	10
Source Code: A992 Rad Nonroutine	19,508	5	0.5	3	1	10
Source Code: A540 LLW/CA Routine	771	0.1	0.5	3	5	9
Source Code: A792 LLW/CA Routine	879	0.1	0.5	3	5	9

Waste description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
Source Code: A010 LLW/CA Routine	415	0.01	0.5	3	5	9
Source Code: A292 LLW/CA Routine	5	0.01	0.5	3	5	9
Source Code: A370 LLW/CA Routine	0	0.01	0.5	3	5	9
Source Code: A390 LLW/CA Routine	0	0.01	0.5	3	5	9
Source Code: A400 Rad Routine	10	0.01	0.5	3	5	9
Source Code: A580 LLW/CA Routine	2	0.01	0.5	3	5	9
Source Code: A592 LLW/CA Routine	10	0.01	0.5	3	5	9
Source Code: A593 Rad Routine	60	0.01	0.5	3	5	9
Source Code: A595 Rad Routine	242	0.01	0.5	3	5	9
Source Code: A596 Rad Routine	60	0.01	0.5	3	5	9
Source Code: A710 Rad Routine	40	0.01	0.5	3	5	9
Source Code: A793 LLW/CA Routine	42	0.01	0.5	3	5	9
Source Code: A943 LLW/CA Routine	13	0.01	0.5	3	5	9
Source Code: A943 Rad Routine	415	0.01	0.5	3	5	9
Source Code: A530 RCRA Nonroutine	1,262	1	1	5	1	8
Source Code: A593 RCRA Nonroutine	2,650	1	1	5	1	8
Source Code: A090 RCRA Nonroutine	374	0.01	1	5	1	7
Source Code: A510 RCRA Nonroutine	381	0.01	1	5	1	7
Source Code: A532 RCRA Nonroutine	254	0.01	1	5	1	7
Source Code: A562 RCRA Nonroutine	187	0.01	1	5	1	7
Source Code: A572 RCRA Nonroutine	34	0.01	1	5	1	7
Source Code: A582 RCRA Nonroutine	283	0.01	1	5	1	7
Source Code: A612 RCRA Nonroutine	281	0.01	1	5	1	7
Source Code: A792 RCRA Nonroutine	407	0.01	1	5	1	7
Source Code: A920 RCRA Nonroutine	0	0.01	1	5	1	7
Source Code: A930 RCRA Nonroutine	1	0.01	1	5	1	7
Source Code: A940 RCRA Nonroutine	1	0.01	1	5	1	7
Source Code: A990 RCRA Nonroutine	25	0.01	1	5	1	7
Source Code: A592 DTSC Nonroutine	3,025	1	1	4	1	7
Source Code: A592 TSCA Nonroutine	1,132	1	1	4	1	7
Source Code: A792 TSCA Nonroutine	3,358	1	1	4	1	7
Source Code: A370 Nonhazardous Routine	1,370	1	0.1	0.1	5	6
Source Code: A498 Nonhazardous Routine	2,490	1	0.1	0.1	5	6
Source Code: A593 Nonhazardous Routine	2,274	1	0.1	0.1	5	6
Source Code: A595 Nonhazardous Routine	3,675	1	0.1	0.1	5	6

Waste description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
Source Code: A780 Nonhazardous Routine	4,989	1	0.1	0.1	5	6
Source Code: A793 Nonhazardous Routine	2,739	1	0.1	0.1	5	6
Source Code: A582 DTSC Nonroutine	958	0.1	1	4	1	6
Source Code: A191 TSCA Nonroutine	10	0.01	1	4	1	6
Source Code: A410 TSCA Nonroutine	9	0.01	1	4	1	6
Source Code: A492 TSCA Nonroutine	500	0.01	1	4	1	6
Source Code: A496 TSCA Nonroutine	126	0.01	1	4	1	6
Source Code: A497 TSCA Nonroutine	274	0.01	1	4	1	6
Source Code: A498 TSCA Nonroutine	8	0.01	1	4	1	6
Source Code: A530 TSCA Nonroutine	413	0.01	1	4	1	6
Source Code: A532 DTSC Nonroutine	97	0.01	1	4	1	6
Source Code: A550 TSCA Nonroutine	30	0.01	1	4	1	6
Source Code: A562 TSCA Nonroutine	42	0.01	1	4	1	6
Source Code: A570 TSCA Nonroutine	12	0.01	1	4	1	6
Source Code: A572 DTSC Nonroutine	145	0.01	1	4	1	6
Source Code: A580 TSCA Nonroutine	38	0.01	1	4	1	6
Source Code: A582 TSCA Nonroutine	5	0.01	1	4	1	6
Source Code: A792 DTSC Nonroutine	227	0.01	1	4	1	6
Source Code: A930 DTSC Nonroutine	137	0.01	1	4	1	6
Source Code: A930 TSCA Nonroutine	10	0.01	1	4	1	6
Source Code: A940 TSCA Nonroutine	252	0.01	1	4	1	6
Source Code: A941 TSCA Nonroutine	24	0.01	1	4	1	6
Source Code: A530 Sewered Nonroutine	18,210	5	0.001	0.001	1	6
Source Code: A593 Sewered Nonroutine	5,405	5	0.001	0.001	1	6
Source Code: A593 Sewered Routine	2,283	1	0.001	0.001	5	6
Source Code: A600 Sewered Routine	1,660	1	0.001	0.001	5	6
Source Code: A790 Sewered Routine	1,245	1	0.001	0.001	5	6
Source Code: A610 LLW/CA Nonroutine	4,438	1	0.5	3	1	6
Source Code: A040 Nonhazardous Routine	955	0.1	0.1	0.1	5	5
Source Code: A090 Nonhazardous Routine	573	0.1	0.1	0.1	5	5
Source Code: A350 Nonhazardous Routine	664	0.1	0.1	0.1	5	5
Source Code: A592 Nonhazardous Routine	922	0.1	0.1	0.1	5	5
Source Code: A941 Nonhazardous Routine	526	0.1	0.1	0.1	5	5
Source Code: A990 Nonhazardous Routine	607	0.1	0.1	0.1	5	5
Source Code: A293 Nonhazardous Routine	88	0.01	0.1	0.1	5	5

Waste description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
Source Code: A320 Nonhazardous Routine	2	0.01	0.1	0.1	5	5
Source Code: A496 Nonhazardous Routine	282	0.01	0.1	0.1	5	5
Source Code: A550 Nonhazardous Routine	102	0.01	0.1	0.1	5	5
Source Code: A570 Nonhazardous Routine	51	0.01	0.1	0.1	5	5
Source Code: A580 Nonhazardous Routine	114	0.01	0.1	0.1	5	5
Source Code: A594 Nonhazardous Routine	286	0.01	0.1	0.1	5	5
Source Code: A710 Nonhazardous Routine	415	0.01	0.1	0.1	5	5
Source Code: A740 Nonhazardous Routine	65	0.01	0.1	0.1	5	5
Source Code: A943 Nonhazardous Routine	25	0.01	0.1	0.1	5	5
Source Code: A780 Sewered Routine	830	0.1	0.001	0.001	5	5
Source Code: A920 Sewered Routine	639	0.1	0.001	0.001	5	5
Source Code: (blank) Sewered Routine	374	0.01	0.001	0.001	5	5
Source Code: A602 LLW/CA Nonroutine	750	0.1	0.5	3	1	5
Source Code: A750 LLW/CA Nonroutine	887	0.1	0.5	3	1	5
Source Code: A940 Rad Nonroutine	774	0.1	0.5	3	1	5
Source Code: A492 LLW/CA Nonroutine	415	0.01	0.5	3	1	5
Source Code: A492 Rad Nonroutine	387	0.01	0.5	3	1	5
Source Code: A510 Rad Nonroutine	457	0.01	0.5	3	1	5
Source Code: A530 Rad Nonroutine	135	0.01	0.5	3	1	5
Source Code: A532 LLW/CA Nonroutine	0	0.01	0.5	3	1	5
Source Code: A532 Rad Nonroutine	255	0.01	0.5	3	1	5
Source Code: A550 Rad Nonroutine	58	0.01	0.5	3	1	5
Source Code: A560 LLW/CA Nonroutine	4	0.01	0.5	3	1	5
Source Code: A560 Rad Nonroutine	390	0.01	0.5	3	1	5
Source Code: A582 Rad Nonroutine	2	0.01	0.5	3	1	5
Source Code: A593 Rad Nonroutine	185	0.01	0.5	3	1	5
Source Code: A792 LLW/CA Nonroutine	320	0.01	0.5	3	1	5
Source Code: A792 Rad Nonroutine	147	0.01	0.5	3	1	5
Source Code: A930 Rad Nonroutine	10	0.01	0.5	3	1	5
Source Code: A932 Rad Nonroutine	106	0.01	0.5	3	1	5
Source Code: A992 LLW/CA Nonroutine	492	0.01	0.5	3	1	5
Source Code: A530 Nonhazardous Nonroutine	1,238	1	0.1	0.1	1	2
Source Code: A562 Nonhazardous Nonroutine	2,825	1	0.1	0.1	1	2
Source Code: A610 Nonhazardous Nonroutine	4,355	1	0.1	0.1	1	2
Source Code: A570 Sewered Nonroutine	3,735	1	0.001	0.001	1	2

Waste description	Total (lb)	Quantity factor	Cost factor	Waste type factor	Opera-tional factor	Weighting factor total
Source Code: A930 Sewered Nonroutine	3,262	1	0.001	0.001	1	2
Source Code: A510 Nonhazardous Nonroutine	664	0.1	0.1	0.1	1	1
Source Code: A492 Nonhazardous Nonroutine	230	0.01	0.1	0.1	1	1
Source Code: A560 Nonhazardous Nonroutine	211	0.01	0.1	0.1	1	1
Source Code: A582 Nonhazardous Nonroutine	50	0.01	0.1	0.1	1	1
Source Code: A592 Nonhazardous Nonroutine	18	0.01	0.1	0.1	1	1
Source Code: A593 Nonhazardous Nonroutine	415	0.01	0.1	0.1	1	1
Source Code: A792 Nonhazardous Nonroutine	52	0.01	0.1	0.1	1	1
Source Code: A792 Sewered Nonroutine	668	0.1	0.001	0.001	1	1
Source Code: A492 Sewered Nonroutine	415	0.01	0.001	0.001	1	1